RAILROAD GAZETTE

FRIDAY, FEBRUARY 15, 1901.

CONTENTS

Contributions

Accident Record—A Correction.

Chicago, Burlington & Quincy Railroad Co.,
Chicago, Feb. 11, 1901.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Allow me to correct an error in the train accident report in the *Railroad Gazette* of Feb. 1. The accident under head of derailments due to defective roadway on Dec. 15, near Murray, Iowa, did not occur on C., B. & Q. track, but on a narrow-gage contractor's track used in building a new C., B. & Q. line. The rear car of a train of dump cars unloading on the trestle turned over and fell, carrying with it the remaining cars. The trestle was not damaged. One man was killed and two injured.

W. L. BRECKENRIDGE,
Chief Engineer.

Crossed and Open Eccentric Rods.

Roanoke, Va., Feb. 10, 1901.

TO THE EDITOR OF THE RAILROAD GAZETTE.

I note an article on page 99 of your issue of Feb. 8 in which the term "crossed rods" is used incorrectly. The terms "open and crossed" rods are unfortunate, as any arrangement of the rods is both open and crossed once for each revolution. If the crank pin in Fig. 2 of the article referred to be turned to the back center, the rods will be open and the centers of the eccentrics will occupy the relative positions between the shaft center and the link as in Fig. 1 or Fig. 3. The only way to "cross" the rods is to cross them when the eccentrics occupy this position, and would result in a valve motion having decreasing lead instead of increasing it. I know of no successful locomotive designed with decreasing lead and the motions designed for constant lead have not obtained much recognition.

Engines are being built with the eccentric arrangement as per Fig. 2, but they do not have decreasing lead, and are not "crossed rods." C. A. SELEY,
Mechanical Engineer Norfolk & Western Ry.

Premiums for Undertime.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Some time when you are writing on the question of payment of railroad trainmen, I wish you would take this into consideration:

Most railroads pay overtime to crews of trains which consume more than a specified time making the runs. For example, the run over a division will pay one and one-half days and overtime after eighteen hours. Why wouldn't it be a good idea to pay a premium for making the same run in less than the average time it takes to make these runs? Suppose 15 hours is a fair average for slow freights on the above-mentioned runs, that that time be established from which to reckon premium time, and that crews of slow trains making the runs in less time be paid a premium for, say, each twenty minutes saved, wouldn't there be an incentive to make premium time rather than overtime, and thereby get trains and power around more promptly?

SUPERINTENDENT.

Railroads in Cuba.

TO THE EDITOR OF THE RAILROAD GAZETTE.

I have been much interested in your recent editorial articles on railroads in Cuba and the Philippines, and especially in Cuba. I imagine that Sir William Van Horne's company will not be injuriously interfered with in their railroad construction, which you justly estimate as one of vital importance for the Island interests. It would also be an exceilent thing if the company could acquire all the existing railroad franchises and so effect a consolidation of the railroad interests and administration.

While I was in Havana I found the Englishmen much more enterprising than our own people in the direction of making investments, apparently having greater faith that the future of the Island would be securely safeguarded under American authority than did Americans themselves, in view of the political uncertainties. What capital needs, of course, is some assurance of protection, and on this side of the water we have acquired by experience and knowledge of the conditions obtaining in Spanish-American republics a rooted distrust of their security or responsibility. It would doubtless be a pity to repeat in Cuba the experiments that have been shown fruitless in Central America, where the only serious government is that of Mexico, which, while nominally a republic, is in fact a dictatorship, in the very competent hands of Diaz.

W. L.

Administrative Responsibility on German Railroads.

Washington, D. C., Jan. 31, 1901.

TO THE EDITOR OF THE RAILROAD GAZETTE.

I have read your editorial of Jan. 25 on the Offenbach accident, with comments on the explanation made by an official of the railroad on which it occurred. As you seem to have overlooked some features of the relations of the State Railroad officials to the State and to the public which forms the State, you will, I trust, allow me a word in elucidation of the subject.

The State Railroads are not able to do anything in the way of improvement which the officers of any special system, worked by what is called a directory, may think best; neither is the Ministry of Public Works, which works the whole system. The latter reports to the Prussian Diet what it regards as desirable, with estimates for the expenditure necessary. What the Diet approves, the Ministry can carry out. The Diet has approved and granted appropriations for block signals, the expenditure to be distributed over a series of years ending with 1903. The railroad management has no power to do this work any sooner, any more than a Superintendent here would be able to make expenditures for new construction without authority from his board of directors. The Diet has authorized expenditures for distant signals only at stations, and not at intermediate block signals. So it is a perfect answer for the Frankfort directory to quote this law. So far as they are concerned, they could not put up a distant signal there.

Doubtless, in a general way, the Diet, or legislative body, depends on the Ministry of Public Works for his recommendations as to what is needful; but if he gets all that he wants, or would like to recommend, he must be very lucky. The other departments of government usually all want more than they can get, and the final estimates are always a compromise.

Further, in the matter of regulations, the officials of any part of the railroad system have a perfect right to justify themselves by the code of rules. They have not made the code. In fact, it is imposed upon them by a higher authority than the State itself—by the Empire; a uniform code being considered indispensable because in case of war all the railroads of all the States in the Empire come under imperial control. Doubtless modifications or additional rules not contrary to the Imperial code, could be added, and possibly one might have been permissible prohibiting backing out of a section after having overrun a signal.

It has been pointed out, in Germany, since this semi-official account of the accident, that the Imperial code of regulations does require an absolute stop at all block signals, whether at stations or between them, "by all means in the engineman's power," so that the statement in the explanation, that a slight overrunning of such an intermediate signal is not a serious matter runs counter to the rules. And as it is recognized that in a fog overrunning cannot be prevented without distant signals, the necessity of the general introduction of these seems now to be acknowledged. It is to be expected that application for authority to do this will be made at the present session of the Prussian Diet. W. H.

[It seems against efficient conduct of business that a local administrative officer may clear his own skirts by pointing out the faults of his superiors, but that is Germany's business, not ours. We ought, perhaps, to repeat that in our opinion the primary cause of the collision was the negligence and misconduct of the engineman of the foremost train. His error in setting back differed from his error in running past the signal chiefly in being somewhat unusual. The error of running past a signal is, quite likely, a common one. But the rule requiring an engineman to be prepared to stop at a stop signal unless and until he can be perfectly sure that it indicates go-ahead, is the vital element of all block signaling. Its importance is not diminished by a fog, but rather increased. It applies in full force even if, by reason of fog, it necessitates slackening speed at every block for a hundred miles. If the German code does not clearly require this, it is not sufficient to say that the code is imperfect in its block signal chapter; we ought to say that there is really no effective block signal code whatever. We judge, however, that the code does contain this requirement; and that, therefore, the fundamental trouble was imperfect discipline. For faults of discipline a local officer would not be likely to try to throw blame on his superiors, and it is significant that in the defense in this case no attempt in this direction was made.—Editor Railroad Gazette.]

Shall a Canal be Built From the Lakes to the Sea?

BY WILLIAM G. RAYMOND.*

There is before the people of the State of New York a proposition to enlarge the Erie Canal at an approximate expense of $62,000,000. The enlargement proposed is to be such as will permit the handling of barges of 1,000 tons capacity requiring a depth of 12 ft. The able Commission appointed in 1899 by then Gov. Theodore Roosevelt, to suggest an answer to the question, What shall be done with the New York State Canals? suggested the 1,000-ton barge canal, and indorsed it for the following fundamental reasons:

1. Without cheaper transportation New York City cannot hope to hold the commercial supremacy on this continent, and cheaper transportation will greatly stimulate business, especially manufactures.

2. Transportation by water is cheaper than by rail, and the less restricted the waterway the less the cost of transportation.

3. Aside from the indirect and unmeasureable benefits to the State from its construction and operation the Erie Canal has paid the State many millions of dollars more than it has cost; were this not so the enlargement would not be advised.

There is before the people of the United States a proposition to build a ship canal from the lakes to the sea, the route advised by the Commission appointed by the President being: The Niagara River from Buffalo, to La Salle, to Lewiston, to Lake Ontario, to Oswego, thence to and through Lake Oneida and through the Mohawk Valley to the Hudson. The depth advised by this same Commission is 21 ft., and the cost of carrying out the project at $200,000,000, including certain improvements necessary on the lakes and the passages between them to secure 21 ft. depth throughout the entire route.

It is believed to be fair to ask: Why should either of the proposed waterways be built? Why should not the State of New York dispose of its canals to private interests, if possible, or fill them up? Referring to the reasons offered by the New York State Commission for building the barge canal it may be said:

1. It is doubtful if the Erie Canal is, or, if improved, would be, any great factor in maintaining the commercial supremacy of New York City.

2. Transportation by water is not inherently cheaper than by rail.

3. The Erie Canal has not paid the State directly many millions of dollars more than it cost, but on the contrary has cost more than the State has received from it.

It is believed that the truth of these assertions was clearly proved in the *Railroad Gazette* of March 2 and 9, 1900, where it was shown:

1. That the Montreal water route can always be made better than the Erie Canal route.

2. That the lowest cost per ton mile for bulk freight by the barge canal under favorable circumstances will be from 1 1-5 to 1½ mills, without profit to the transportation company, while the cost of the same service by rail may be brought to from ½ mill to 1 mill per ton-mile.

3. That at the close of 1882 when tolls were abolished, the taxes for canal purposes had amounted to $20,005,022 more than the revenue received from the canals; that at the close of 1895, before the recent $9,000,000 improvement began, the excess of taxation over revenue had reached $43,364,858; and at the close of 1898 the excess had become $50,150,662. The excess is now growing at the rate of from $1,500,000 to $2,000,000 annually.

By a somewhat different line of reasoning Mr. Joseph Mayer has shown† that as between the present Erie Canal and the enlarged barge canal, even assuming the barge canal to secure a business equal to its full estimated capacity of 20,000,000 tons annually, the State of New York would lose about $800,000 yearly by constructing the barge canal.

An examination of the preliminary report for 1900 of the Comptroller and Superintendent of Public Works of the State of New York reveals the fact that in addition to the regular canal tariff paid by the shippers, the State is paying about 2½ mills per ton mile for all the freight that goes through the canal. The railroads have carried grain from Buffalo to New York for 2 mills per ton mile, total charges to the shipper, and have paid millions of dollars to the State for the privilege. The Chesapeake & Ohio Railroad last year carried all the coal that went over its road for an average charge of 2.02 mills a ton-

*Professor of Geodesy, Road Engineering and Topographical Drawing, Rensselaer Polytechnic Institute.

†Proceedings Am. Soc. C. E., Vol. xxvii., No. 8, Oct. 1900.

mile; its average revenue for all classes of freight was only 3.43 mills a ton-mile; and its financial results for the year were the best yet recorded.

In view of all these facts it seems decidedly pertinent to ask:

How can any ultimate economy be shown for the barge canal? Why should the present canal be longer maintained at State expense?

As to the economy of the Ship Canal little can be asserted. Mr. Mayer in the paper already quoted from asserts that the saving in cost of transportation will average about $1.50 per ton from Western lake ports in comparison with equally good service at present available. But Mr. Mayer counts on an annual tonnage of 36,000,000 tons, which is probably double what will traverse the New York State end of the ship waterway for many years, and apparently no account has been taken of the possibility of further reduction in rail rates. The steady reduction of these rates in the past, made possible by the advances in the science of railroading, has been marvelous, and the end seems not to be in the immediate future. Therefore, it seems to be folly to assert any definite saving in freight charges or to spend hundreds of millions of dollars in an enterprise that is of questionable immediate utility, and that is almost sure to be outclassed in competition within a few years after its completion.

It is asserted by some that either of the proposed canals will be worth all it costs even if never a boat goes through, because either of them will be a potential regulator of rail rates. In the light of the history of rail rates for the years that have passed, it seems, in spite of the assertions of able men to the contrary, that the Erie Canal has for many years had little influence in controlling transportation rates. The truth is the railroads have fixed the rate, and the canal has had to be satisfied with a less rate for the leavings of the railroad. It is, perhaps, because the rail rate has always been the higher that this fact has not been fully appreciated.

From 1868 to 1873 the canal rate on wheat from Buffalo to New York was from 10c to 12c a bushel, while the rail rate was from 12c to 16c. The canal did perhaps 60 per cent. of the grain hauling to New York. A gradual lowering of the rail rate forced down the canal rate till a point was reached in 1880 when it was no longer possible for the canal boatmen to do business and pay toll. Then the State was asked to come to the aid of the boatmen by giving them a free waterway, and the result was one of the queerest things in the history of the State. The State was placed in the position of furnishing and maintaining a free roadbed at great cost for one class of transportation interests to enable it to compete with another class which must not only bear all its own expenses of every kind, but must help pay for the free way of its rival protected by the State.

Suppose the canal has been a regulator of rates; is this a just or economical method of control? Is it just for the parent to rob one child to advance his brother?

But the removal of tolls did not much better matters. Rail rates have been steadily reduced, business has required rapid movement of freight, and the canals are now generally acknowledged to be out of the race. It will, of course, be said that this is a false argument, that the existence of the canal is what brought the rail rates down, and that in dying the canal has saved the State. It may be asserted with positiveness that this is not true. Rail rates have been gradually reduced all over the country, where there is water competition and where there is not. It is no argument to say that parallel with water competition rail rates are lowest, because in general it is parallel with water lines that the greatest business lies, and that it can be handled by rail at the least expense.

Was the business built up by the waterways? In many instances; perhaps in all; but the valley rather than the highland is the natural location for great industries and cities, and the canal helped simply because it was the first and only known transportation line.

"Where combination is possible competition is impossible." It is practically certain that with a barge canal or a ship canal, combination of transportation interests will be possible. Of what use then will it be to the people to undertake either canal?

A little time since the Delaware & Hudson Canal Company abandoned its canal to the Hudson River. Certain independent coal interests formed a company, purchased the canal and sought to build in its place a railroad that would enable them to bring their coal to tidewater in competition with the railroad coal people. They were opposed at every step but finally obtained the necessary authority to build. The natural result followed; they were bought out.

The comments on this result were various. One engineering journal deplored the outcome as one which would force the people to pay higher rates to provide for interest on the increased indebtedness of the existing companies necessary to purchase the interest of the projectors of the new road. Another suggested that all things considered the result was the best possible conclusion of the matter. It is altogether probable that the second opinion is the more rational, for had the new road, an entirely unnecessary one, been built, a still larger expenditure of capital, on which the people must pay a fair return, would have been necessary, and a combination ultimately inevitable.

So with the canals, if one of those proposed is built, the people must pay the cost of the canal and must further support the water transportation companies, entirely unnecessary organizations, and the railroads in combination with them. Will this be economy? Will the promised great increase in shipbuilding and the iron industry for wholly unnecessary enterprises be ultimately remunerative, or add anything to the wealth of the nation?

The whole discussion has an element of the ridiculus in it. The enterprise is a wholly unnecessary one. The railroads are making no more in proportion to the capital invested than are oil companies, steel companies, mining companies or any other producing or manufacturing concern of importance. Moreover, the farmer, helped by the law of supply and demand, sees his wheat go from 50c to $1 a bushel and calls on New York State to spend, capitalizing annual expenditure, $120,000,000, to enable him, as he believes, to save a cent a bushel. Mr. Carnegie, helped by the same law of supply and demand, modified by his powerful combination, puts up the price of steel from $15 to $35 a ton and cries to the State of New York to build him a canal with which he believes he can cudgel the railroads into a concession of possibly $1 a ton in their rates. It is doubtful if he would ever be a heavy canal shipper. Is there not something ridiculous in this?

But there is a higher ground to take than that of gain and loss; there is an ethical question involved that has been little considered.

Some four years ago the writer of this letter asked in the *Railroad Gazette* if the nation has a right to build the ship canal even if it can be shown to be economical, which is at least doubtful.

There can be no doubt but if the entire transportation business of the country were in the hands of Government, any new departure or improvement that could be shown to be profitable would be justifiable. But it has been the settled policy of this country to encourage private investment in the transportation business, reserving, what is conceded by all interests to be right, the authority to prevent unjust discrimination in the matter of charges for transportation services. Neglecting entirely the question of the wisdom of this policy, it is simply stated that this is the fixed and settled policy in this country.

Is it, then, just for Government to build and maintain a free roadbed for one transportation interest in order that it may compete with another which is taxed heavily to support the free way of the first? This is what New York State will do if it builds a $62,000,000 1,000-ton barge canal. Has Standard Oil or the noted cattle shippers' combination done anything worse?

Is it just for Government to lend its credit to one transportation interest in order that it may compete with another which exists by its own strength without Government aid? This is what the nation will do if it spends $200,000,000 in a ship canal and charges a toll sufficient to pay interest charges and maintenance.

It is submitted, then, with some assurance that the position is correct, that there can be no ultimate economy in the construction of either the barge canal or ship canal, and if even some economy may result, neither enterprise is ethically justifiable.

The Ganz System of Electric Traction.

As we have already related, a good deal of interest has been aroused by the fact that Messrs. Ganz & Co., of Budapest, have come forward with a novel plan for electric equipment of the Metropolitan (underground) railroads in London now worked by steam. Their proposition was so novel, not to say revolutionary, that a special commission was sent to Budapest to investigate. Meanwhile *The Engineer* (London) sent its own commissioner, whose description, with an illustration, appears in the issue of that journal of Jan. 25, and part of that description we reproduce below.

"What is proposed for the London Metropolitan Underground is in principle the same as is being carried out at Como; but the differences between a moderately light and very heavy traffic, of course, result in many constructive modifications; and in the interval since the Italian project was undertaken a good many detail improvements, all in the direction of manipulative simplicity, have been designed, and naturally would be embodied in the London work. As regards the London designs, Ganz & Co., of course, desire that there should be no premature publication of detail figures or particulars of constructive improvements. For these your readers must exercise patience until the seals of the tenders have been broken. For purposes of illustration I must therefore refer to the Italian line. But the differences are, many of them, only what are inevitably due to the differences of condition. Thus, on the Italian line, each motor truck carries two motors, whereas, in London, each fore and each hinder motor car would carry four motors, or eight for each train. In both schemes two trolley wires and the rails carry three-phase currents of 3,000 volts. The insulated mains in Italy are three-phase at 20,000 volts; but it is proposed to use a much lower voltage in London. The three-phase current travels by the rails with contact by the driving wheels of the motors. Every part bringing current from the trolley poles through the motor is entirely encased in metal, so that there is no possible danger to life or limb by contact with any accessible part. This applies equally, of course, to the interior of the driving cab as much as to the places to which the public has access. I will later have several opportunities of describing how thorough and painstaking and ingenious are the arrangements for securing apparently absolute immunity from risk. The trolleys are bronze cylinders running on ball bearings upon a wooden shaft fitted with steel ball races. The current does not come through the ball bearings, but through an end collar face by a carbon brush held up by a spring. Two such trolleys for the two phases are mounted on the same shaft, which is of quite special preparation. This shaft has a spring suspension at its two ends on the trolley pole. The pole is held up by spiral springs at its base, and these springs are kept in tension by air-pressure on a piston. The explanation of the object and method of this compressed air abutment I must reserve for another article. It is an important safety appliance. Westinghouse air-brakes are used upon the Italian line, and compressed air performs many functions in the working of the system. The standard air pressure is automatically maintained in a reservoir by an electro-motor-driven compound air pump, the motor being automatically cut out when the air pressure reaches the standard.

"The motors are pure induction three-phase motors. They are arranged in pairs, high and low tension. The arrangement is not correctly comparable to that of a compound steam engine, and therefore the name "Cascade" has been invented to describe, or rather to identify, it. Each motor consists of a higher tension stator and a lower tension rotor. From the trolleys and the rails the 3,000 volt three-phase current enters the stator of the high-tension motor. This induces in the rotor of this motor, a three-phase current, which is, during starting and up to half speed, taken into the stator of the low-tension motor. The current induced in the rotor of this latter is taken through a non-inductive liquid-resistance rheostat, which I will later more fully describe, but which is automatic in its action of reducing —at a controllable speed—the resistance from maximum to zero. When half speed has been reached, the low-tension motor is entirely cut out of circuit, and thereafter runs idle, while at the same instant the full rheostat resistance is switched out of its rotor circuit and into the rotor circuit of the high-tension motor. Here it is once more automatically reduced from maximum to zero during acceleration from half to full speed. This rheostat is an extremely important part of the whole system, the obtaining of smooth and easy acceleration depending upon its very special construction. In slowing down this series of operations is reversed.

"In slowing to half speed the retardation is entirely electrical, and during this period three-quarters of the kinetic energy of the train is absorbed and pumped back into the line as three-phase electric current energy by the dynamo action of the motors. Only one-quarter of this kinetic energy thus remains to be dealt with by the Westinghouse brakes. Herein lies evidently an important saving of driving power on a line with short-distance stations, and an immense saving of wear on brake blocks, tires and rails, as well as a very material saving of nerves in the bodily frames of the passengers.

"Equally important is the mechanical mounting of the motor and the mechanical method of driving the wheels. The stator, or fixed inductor of the motor, is a ring rigidly bolted to the body frame. The rotor runs on bearings which are similarly rigidly fixed; in fact, for convenience of mounting the bearings form part of the steel casting of the stator. The rotor thus runs always true inside the polar surfaces of the stator without vibrating displacement; its axis is geometrically rigid in the frame. The bearings run flooded in oil, retained by leather caps. The one end of the rotor body casting is expanded into a one-sided flange. To two points of this flange are pinned the first two links of a kinematically beautiful linkage of five links, which connects the rotor to the driving wheel. The driving wheel is driven at two pin joints, and the forces acting upon it at these two joints are at every instant opposite and equal, thus forming a pure couple. The wheel is thus subjected to no central bearing pressure by the driving forces. The kinematic effect of the linkage, which I will describe more particularly later on, is to compel the wheel to rotate accurately along with the rotor, but at the same time to allow it freedom—within limits—of translatory motion, carrying its center in any direction from the center of the rotor. The two wheels are keyed in the ordinary way upon an axle, and this axle passes through the core of the rotor, this core being bored 4¼ in. larger than the axle. Thus the latter is free to move excentrically 2 in. from the rotor center. The axle runs in axle boxes sliding in horn-plates in the usual manner, and through leaf springs shackled to the body frames, carries the whole load—including weight of rotor—on springs in ordinary style. Without a diagram it is difficult to explain the possibility of this result. This will be given later. I consider this driving mechanism a very important triumph of mechanical design over a difficulty which has for many years baffled the ingenuity of many traction engineers. Much of the excellence of the new Ganz system is due to this mechanical feature.

"In the distribution of power, as no continuous current is used, the sub-stations are simple stationary transformers from three-phase high-tension to three-phase low-tension. The saving due to absence of converters is, of course, of first class importance, not only in respect of first cost, which, in my opinion, must necessarily make Ganz & Co.'s tender much lower than that of any other using continuous current in the motors; but it is also clear that the saving in attendance and repairs at sub-stations must be very great. In fact, these sub-stations require nothing but periodical inspection. They require no more attendance than do the hundreds of similar lighting transformer stations already existing in London. The sub-stations are far apart, and, in fact, for the Metropolitan Underground only five sub-stations are needed. Such is the barest outline of this new and re-

markably cleverly developed system, which bids fair to make a revolution in certain classes of railway traction, and the knowledge of which has within these few days changed my own opinion regarding one tremendous problem of the future which, however, is apart from the narrower subject at present under hand."

Readville Car Shops—New York, New Haven & Hartford.

The New York, New Haven & Hartford Railroad is building an establishment of car repair shops at Readville, Mass., which, when completed, will probably be the most extensive plant of its kind in this country, and will have a capacity for repairing 120 passenger and 1,000 freight cars per month. They are to be situated about 10 miles from Boston at the junction of the Providence and Midland Divisions. The site lies between the tracks of the Midland Division and the Dedham Branch and covers about 72 acres. The ground was originally good gravel and, for years, furnished a great deal of ballast. After it had been decided that it would be a desirable place for a shop the process was reversed and much of the old excavation was filled with cinders, ties and other refuse. This continued until last November, when ground was broken and the grading for the shops begun. This grading is not yet completed and probably will not be for some time to come. Meanwhile, however, the foundations for the buildings are being put down and the work pushed as fast as the condition of the ground and the weather will permit. The tracks of the Midland Division and the Dedham Branch, which skirt the premises, are on fills that raise them above the grade adopted for the grounds; the former being elevated to a height of about 20 ft. at the Sprague street crossing. Some idea of the work involved in the preparation of the ground can be gained from the map in which the irregular dotted line passing through the freight shop and the mill represents the section of the grade with the bluff formed by the excavations when the property was used as a borrow pit. The high ground lies to the west of this line. The grade adopted is of 0.3 per cent. with the highest point at the west end of the curve of the loop which is at the extreme right of the engraving. As will be seen, there is a belt line surrounding the grounds from which tracks are led off to the several buildings and yards. The space left vacant in the bend of the loop and to the eastward of the same will be left unoccupied for the present and reserved for future extensions.

In laying out the ground especial consideration was given to drainage. There is a broad midway between the main group of shops and the tracks running through the freight shop. Down the center of this midway there is to be an 18-in. pipe with side branches leading off at right angles and at frequent intervals to the limits of the premises. These cross drains have drop inlets between the tracks and catch basins outside of the last line of rails so that there can be no standing water.

The filling over considerable areas amounted to from 8 ft. to 12 ft. with the removal of masses of old ties buried under piles of cinders to get a suitable footing for foundations. Even with the large amount of material available in the banks at the west, it will require about 100,000 cu. yds. extra to bring the yards up to grade. Work is being pushed so that the earth may have as long a time as possible (at least a year is desired) before the granolithic pavements of the floors are laid. Foundations are being put down, and up to the present, those for the dry kiln, coal, boiler and powerhouse, one-half of the freight shop, erecting shops, transfer table, one-half of that of the cabinet shop, the paint shop and stack, are down. When the buildings are done there will be about 10 acres under cover.

The buildings are to be of brick on stone foundations with nearly flat roofs carried on wooden trusses having intermediate supporting posts for the long spans. The dry kiln will be divided into five bays and be heated by air blown over the material. This is to be placed upon iron trucks and run in to remain for five days. It is estimated that each bay will have a capacity sufficient to hold a day's supply for the works.

The coal shed will receive its supplies directly from the track running alongside. The building, which is to have a length of 150 ft., will be divided so that 30 ft. will be used for coal storage, 55 ft. for boilers and 65 ft. for the power room. The boilers will have a capacity sufficient to supply steam to engines of 1,500 h.p., and these will, in turn, be used for driving dynamos for current, by which the several shop units will be driven. The details of the distribution of this electric energy and the arrangement of the units in the several shops, has not yet been positively determined but they will probably be small and on the approved plan of avoiding long lines of shafting. The stack alongside the powerhouse will be 150 ft. high on an octagonal base 7 ft. across. It will be of brick with a firebrick lining. This power plant will also supply the heat for warming the shops in winter. This will be by hot water circulation and, as far as possible with the exhaust steam from the engines. The water supply will be obtained from driven wells, which are expected to supply all the water needed for the operation of the plant, though a meter connection will be made with the local water works. Fire lines are to be laid and directly connected with the local water supply, and thus maintained under pressure at all times. For this service an annual rental will be paid.

The buildings, including the blacksmith shop, iron machinery shop, truck shop, shop for piping, lining and buffing, and cabinet shops, have a common length of 200 ft., with a frontage on line. Between the blacksmith and iron machinery shops there is no means of direct communication save by small doors at either end. Along the eastern front of the buildings a track will be laid with turntables in front of the several doors so that lorrey cars can be used for the easy and rapid transportation of material from one to the other. In addition to this there will be a track leading directly across from the machine to the truck shop. There will be two traveling cranes in the latter. Between these buildings and the erecting shop there is a space of 100 ft.

The storehouse and offices is one of the few buildings to which a second story will be added over a portion of the same. The distance over which this second story extends will be 50 ft. In the storehouse proper the floor will be the natural earth tamped, upon which will be laid 6 in. of concrete with a covering of 1 in. of cement.

The erecting shop is to have a partition extending across it at a distance of 40 ft. and the space thus formed is divided into a laundry and a buffing room. On one side about midway of the building there will be a toilet room containing 100 lockers. The roof for this building will have a clear space of 19 ft. between the lower chords of its trusses and the floors. Over each track there will be a monitor with a glass roof and ventilators at the sides. The floor of the erecting shop, as well as that of the paint shop will be formed of a bed of 18 in. of broken stone, upon which there will be laid a covering of 6 in. of concrete.

The paint shop will also be provided with a second story over a portion of its extent. At the south end a space 40 ft. wide will be partitioned off from the main room and this will be divided into two apartments, with a washroom between, to be used as trimming and paint rooms respectively. The washroom will be fitted with the usual accommodations of such a place and will also provide 186 lockers for the use of the men. The floor of these rooms will differ from that of the main paint shop in that it will be formed by a 6-in. layer of concrete covered with 1 in. of cement.

Great pains will be taken in the heating and ventilation of this building. The details have not yet been worked out except in a general way. It is proposed to use the forced draft to send warm, dry air into the shop and, at the same time, use a suction to remove the foul air through ducts in the floor. It is expected that this will prevent dust from being raised and also obviate the difficulties that arise from a predominance of moisture in the air of a paint shop.

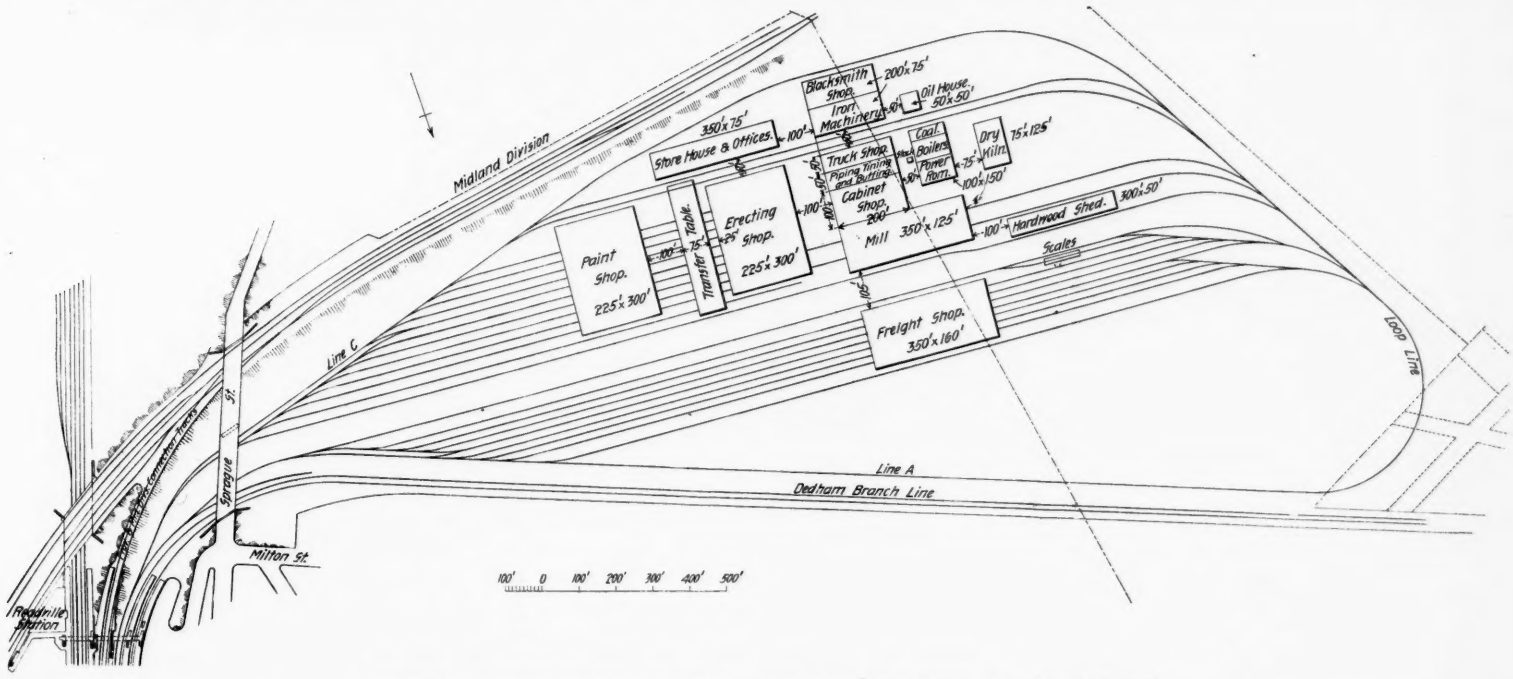
Across the midway the freight car shop will consist of a building 350 ft. long and 160 ft. wide with seven lines of track running through it from end to end.

Outside to the east and west are the two repair and storage yards, connected to the belt line by short ladder tracks. These tracks have been made short, serving four tracks each, so that two switching engines can be worked in each yard without interfering with each other. The No. 7 frog has been used for the majority of the switches on the premises, with a few No. 8. At the west end of the repair tracks, however, it has been found necessary to use No. 6. The grade of these tracks is that of the yard (0.3 per cent.) and drops down from the west to the east. It is expected that the yard will be operated as a gravity yard to some extent, but cars will be fed in from the east (left in the engraving) and sent through the shops and thence hauled out on the loop at the west (right) and out over the line A.

The shops thus planned will be surrounded by ground of such ample dimensions as to provide for any extensions that may be needed for a number of years to come. As already stated, the space north of the freight car shop will remain vacant for the time being, while that immediately west of the dry kiln will be used as a lumber yard.

The work is not yet sufficiently advanced to demand an immediate selection of all of the machinery that will be used, though some of the heavier pieces that will require special foundations will have to be determined upon very soon. Mr. Appleyard, the Master Car Builder, has been engaged for some time in designing special machinery for portions of the work that will have to be done. Electricity will be extensively used for special work and ample provision will be made for a supply of compressed air sufficient for all requirements. Electricity will probably be used as a motive power for the transfer table between the erecting and the paint shop, and compressed air will be piped to all shops where needed for hoisting purposes, as well as throughout the repair yards, where it will be used for hoisting, brake testing and painting.

The magnitude of the plant and the fact that it is to be erected upon open ground will make its operation of great interest as a practical exemplification of modern ideas. Hence, as the details are developed and the whole brought into a working condition, it will form the subject of future articles.



General Plan of the Readville Car Shops—New York, New Haven & Hartford Railroad.

Chicago Track Elevation.

Several ordinances are in preparation for more track elevation at Chicago, but none of these have been approved by the railroads. At a meeting of the Chicago City Council, Feb. 4, an ordinance was passed providing for the elevation of the Pittsburgh, Cincinnati, Chicago & St. Louis, the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern tracks in Kinzie street. An amendment which was added to this ordinance in the council meeting is objectionable to the Northwestern and the ordinance will probably be returned for revision. In the case of each of these roads, this is an extension of the present elevation toward the downtown district.

The Pittsburgh, Cincinnati, Chicago & St. Louis elevation under this ordinance will begin at Fulton street and the Northwestern at Kedzie avenue, both extending

east to Ada street. The Chicago, Milwaukee & St. Paul elevation will be from Grand avenue to a point about 200 ft. west of Western avenue. It is estimated that this work will cost about $1,500,000; twelve subways are provided for and three viaducts will be removed. The work will involve raising about eight miles of roadbed and large yards between Central Park boulevard and Western avenue. The amendment objected to is a clause reserving the right to the city to build a viaduct over the Wells street terminal property of the Northwestern.

An ordinance which will come up soon provides for elevating the tracks of the Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific from the neighborhood of Sixteenth street into the downtown terminal station. Another covers the continuation of the elevation of the Lake Shore, Illinois Central, New York, Chicago & St. Louis and the Pittsburgh, Fort Wayne & Chicago southward and beyond Grand Crossing. On the Illinois Central this involves raising the Fordham yards, and the work at Grand Crossing will also be very expensive. Some of the roads interested are reported as looking upon this work as not essential at this time. Furthermore, their forces are fully employed on elevation work at other points in Chicago.

The Hudson River Railroad.

BY HERBERT T. WALKER.

In the year 1832, 59 years before the "Empire State Express" first swept its way along the banks of the Hudson River, the New York & Albany Railroad obtained a charter to build a railroad between the two cities named; but, for the reason that facilities for navigation on the Hudson River were so great, and the boats so speedy and well equipped for passengers, investors could not be induced to take any interest in the project, and the charter was allowed to expire.

In 1842, the citizens of Poughkeepsie and neighboring towns employed R. P. Morgan, civil engineer, to make a preliminary survey, starting from the Harlem Railroad where it crossed the Harlem River; but, pursuing a more inland route than the one ultimately adopted, and a petition was laid before the Legislature; but the measure was regarded as chimerical and an act of incorporation was refused. In 1845 several business men of New York City made application to the Legislature for a new charter, but with a like result. During the month of September, in the same year, a convention assembled at Poughkeepsie to reconsider the project, taking Morgan's survey as the basis of their action. Soon after the meeting John B. Jervis, civil engineer, was engaged to make a survey as above, but with such deviations as appeared advantageous, and the Legislature was again petitioned for an act of incorporation.

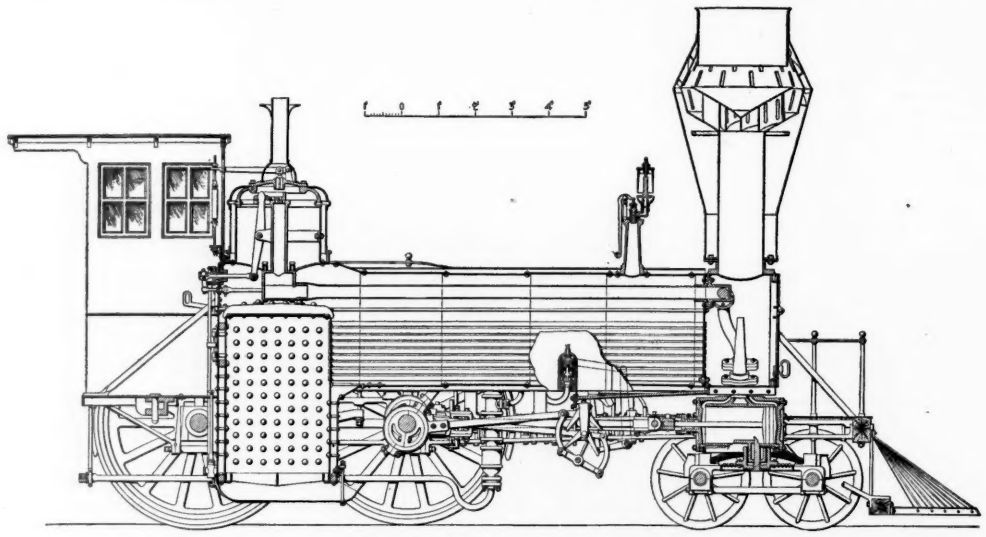
This time the opposition was more determined and came mainly from the Harlem Railroad Company, the directors of which regarded the Hudson River project as adverse to their interests. The land owners along the banks of the river also united their efforts to defeat the measure, one of their objections (in which they were sustained by public sentiment) being that the proposed railroad would be "a desecration of the river, marring its beauty, and subverting the purpose of the Creator."

But the projectors, among whom were Stephen Allen, Mayor Havemeyer, and Gen. James Tallmadge, fought hard, with the result that an act of incorporation was passed May 12, 1846, and soon afterwards a "board of commissioners" was organized to obtain the necessary funds. At this stage of the proceedings, the time-honored argument that as the railroad would have to compete with the swift and palatial Hudson river steamboats, its traffic would not be remunerative, was again advanced with vigor. This objection so discouraged investors, that when the books were opened, very few subscriptions were obtained except those of the commissioners themselves. But, by publishing short articles in newspapers and essays in pamphlets—taking small subscriptions from individuals as they could be persuaded—public enthusiasm was gradually aroused, and by March 1, 1847, subscriptions to the amount of $3,000,000 were obtained and the company was then fully organized with William Chamberlain as President, and John B. Jervis, Chief Engineer.

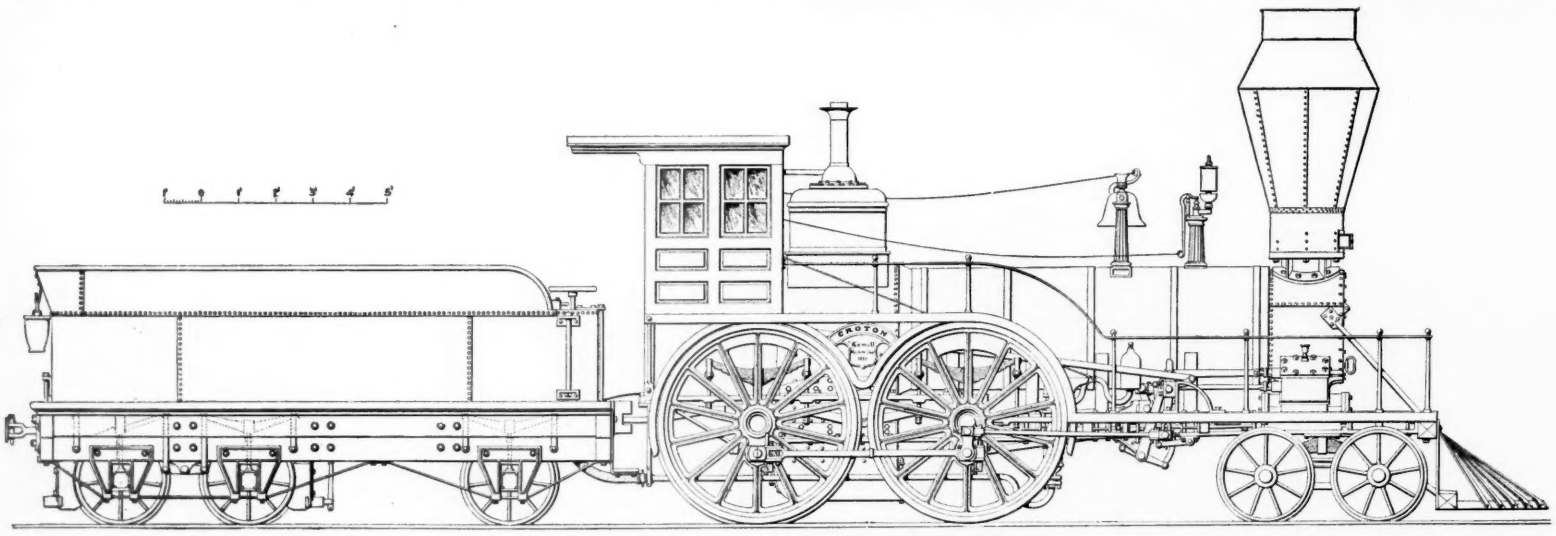
The matter of procuring the right of way having been disposed of—the amounts paid being on an average at least four times the real value of the land taken—the line of work from Thirty-second street, New York, to Breakneck Hill, 53 miles, was offered for contract, and by September, 1847, most of the contracts were let. Construction was difficult, especially the river wall, which was built on a foundation of loose stone brought up to low water level; then the wall was built, work commencing at low tide and continued until the tide rose, then came idleness until the tide fell, when work was resumed. Occasionally it happened that after the wall and embankment had been brought to nearly the proper level, the whole would go down, totally destroying the wall, except so far as it aided by its mass to form a foundation for the future structure. These mishaps ruined some of the contractors and their contracts had to be re-let to others. In the midst of all these troubles, the Directors suddenly passed a resolution requiring the road to be completed to Poughkeepsie by the spring of 1849. This was a serious matter for the Chief Engineer, as can be readily imagined; but, by the use of some temporary trestle work the road was so far completed as to enable a light train to run from Thirty-second street and Ninth avenue, New York, to Peekskill, 40 miles, in September, 1849. Shortly after this time regular trains were running and the traffic arrangements gave general satisfaction. The track (single) was laid with a 70-lb. rail and the company had 10 engines, 25 passenger cars and 71 freight cars.

On Dec. 31, 1849, the line was opened to Poughkeepsie, 75 miles, and a good service of trains was inaugurated. The New York terminus was near Chambers street, but the engines did not run below Thirty-first street, the trains between there and the terminus being drawn by horses, each car separately. The express trains covered the distance (72 miles) in 2 hours 25 minutes, including 12 stops. The loads averaged 94 tons behind the tender. The ordinary trains did the same distance in 2 hours 45 minutes. There were no Sunday trains. At that time the road carried about 900 passengers a day.

The road was opened through to East Albany, Oct. 3, 1851, and the running time of the express trains was then nearly 50 miles an hour. Most of the early engines were designed by Walter McQueen, Superintendent of Motive Power. McQueen may be fairly ranked with the foremost locomotive engineers of this country, and his engines did some of the fastest running in their day. The express engine "Champlain," with 5 ft. 6 in. driving wheels, built in 1849, did some notable work. This engine was built at the Taunton Locomotive Works and was illustrated in the *Scientific American Supplement*, May 8, 1897. The express engines, "Columbia" and "Rensselaer," built at the Lowell Machine Works in 1852, were also remarkable engines, but no drawings of them can be found. Their driving wheels were 7 ft. in diam.; cylinders 16½ in. in diam., by 22-in. stroke. McQueen also designed a very serviceable engine for local trains. It was named "Croton" and is illustrated herewith by a side elevation, longitudinal section and cross-sections. The engine was built at the Lowell Machine Shops and hauled its first train July 24, 1851. The cylinders were 12½ in. in diam. by 20-in. stroke. Driving wheels 66 in. in diam., and truck wheels (Whitney's patent) 30 in. in diam. The outside fire-box was 44 in. wide and came just inside the frames. The back flue sheet was of copper ⅝-in. thick. The boiler barrel was 37 in. outside diameter, containing 118 copper tubes 1¾ in. outside diameter. The fire-box heating surface was 63.39 sq. ft. and the tube surface was 548.7 sq. ft., making a total heating surface of 612.09 sq. ft. The engine burned wood and had a Radley & Hunter patent stack. The manhole cover was secured to the dome by bolts tapped into a ring cast in the underside of the dome top, so that as the steam had no access to them they were preserved from corrosion and were readily removable.



Longitudinal Section of the "Croton."



The Hudson River Railroad Locomotive "Croton"—July, 1851.

Designed by WALTER MCQUEEN, *Superintendent of Motive Power.* *Built at the* LOWELL MACHINE SHOPS.

At the front end of the engine the smoke-box was supported by heavy flanges cast on the cylinders; these flanges being planed and bolted together at the center. As the boiler was bolted to the frames at the fire-box end by heavy angle irons extending the length of the fire-box, there appears to have been no provision made for expansion.

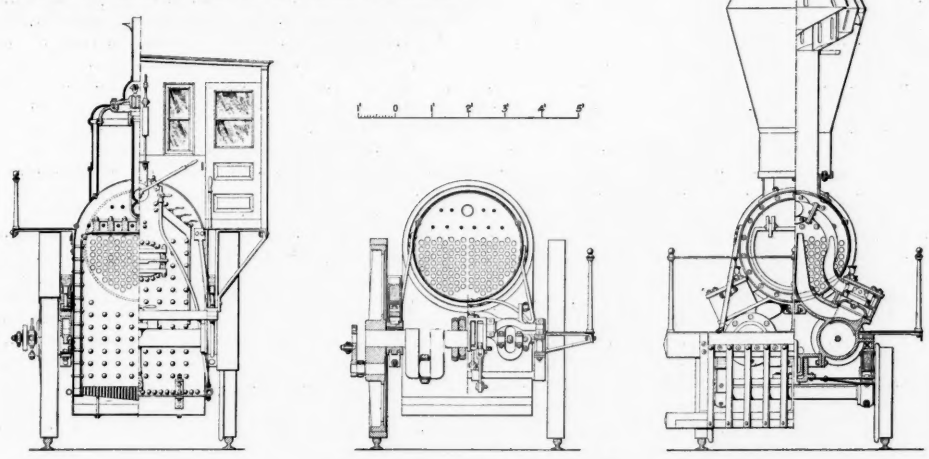
From the cross-section taken through the steam chest it will be observed that two valves were used. The upper one was the expansion valve; it moved on a separate plate above the main valve. This plate was circular, turned conically and ground into a seat bored out for it in the chest. The main valve probably cut off at half stroke, and was worked by drop V-hook motion, clearly shown in the longitudinal section. By referring to the side elevation it will be seen that the tumbling shaft lever for this motion was bent over with an offset to clear the expansion valve rocker shaft. The lever for actuating this hook motion was in the right hand side of the cab, as shown in the half-sectional rear view.

The expansion gear was operated by an outside return crank, the connecting rod of which had a pin passing through a slot in the lower rocker arm; this pin could be moved in the slot and fixed by jam nuts, thus chang[illegible] the stroke of the valve for any desired rate of cut-off. The

upper rocker arm membered with a double V hook forming part of the expansion valve rod. This V hook was thrown in and out of gear by a reach rod that entered the cab on the fireman's side, the handle being visible in the longitudinal section. The tumbling shaft for this gear was journaled in boxes bolted to the lower guide bars.

Although this engine was designed for local traffic it occasionally hauled express trains, and its performance was about equal to that of the express engines, as for instance, in August, 1851, when it pulled an express train from Poughkeepsie to New York, making the usual stops, at an average speed of nearly 40 miles an hour. The train consisted of 6 coaches, 1 baggage car and a track sprinkler, weighing 90 tons, exclusive of engine and tender.

The writer's thanks are due to Mr. David M. Harris, Chief Engineer at the Newark Sewage Pumping Works, Newark, N. J., for the use of the drawings from which accompanying illustrations were prepared.



Cross Sections of the "Croton."

Concerning Rails in England.

We have recently published several articles about the manufacture and life of rails from English reports and investigations. One of these was published Aug. 3, page 526, being an abstract of the important report on the St. Neot's accident made by a committee of the Board of Trade. Others were printed Dec. 28, page 864, and Jan. 4, page 1, these being abstracts of papers and discussions before the Institution of Civil Engineers, treating especially of the wear of rails in tunnels. We mention these articles as introductory to what follows. At the same meeting of the Institution at which Mr. Andrews presented his paper on "The Wear of Rails in Tunnels" the venerable Sir Lowthian Bell presented a paper on "The Development and Manufacture of the Use of Rails in Great Britain." Sir Lowthian Bell is now more than 80 years old, and has been a leader in manufacture of iron and steel for many years, and consequently his paper has peculiar interest. The most of it, however, is quite historical, and therefore we reprint only a few fragments from it, following those extracts with extracts from the discussion.

Sir Lowthian Bell.—With regard to the properties of Bessemer metal, one circumstance has been made sufficiently apparent, viz., the extreme irregularity in the strength of rails so produced.

The following table gives examples of the fall, in feet, needed to produce fracture in rails; the weight is 1 ton:*

Rails 82 lbs. per yard—							
Number of rail	1	2	3	4	5	6	7
Fall, feet	30	30	37½	45	..	..	..
Rails 90 lbs. per yard—							
Number of rail	1	3	2	3	2	2	1
Fall, feet	23½	50	91½	104½	107½	165½	199
Average composition—							
Carbon	0.510	0.483	0.500	0.502	0.475	0.485	0.490
Phosphorus	0.073	0.065	0.080	0.081	0.082	0.068	0.085
Total carbon and phosphorus	0.583	0.584	0.580	0.583	0.557	0.553	0.575

To carbon, when in moderate quantities, hardness and strength are attributed, and to phosphorus brittleness; but the difference in power of resisting fracture, as measured by the fall of the weight, does not correspond with the analyses taken as a whole. The discrepancies are not merely apparent as between separate rails, inasmuch as different parts of the same rail vary considerably when tried under the falling weight.

The author's friend, Professor H. M. Howe, in his classic work on the manufacture of steel, pointed out that the upper portions of an ingot intercept, on cooling and becoming viscous, considerable quantities of gaseous matter. These fill spherical cavities, which in rolling are flattened without any actual welding of the sides of the cells being necessarily effected.

Six ingots were indiscriminately selected and divided into three sections marked tops, middles and bottoms, forming thus eighteen separate rails. The rails rolled out of the different portions of the ingots broke under the falling weight of one ton as follows:

Tops. Aggregate Fall in feet.	Middles. Aggregate Fall in feet.	Bottoms. Aggregate Fall in feet.
52½	76½	76½
13½	52½	103½
52½	52½	52½
22	76½	76½
76½	76½	76½
76½	52½	76½
Average.		
48.9	64.5	77

If, for comparison, the average of the tops be represented by 100, the average of the middles will be represented by 132, and that of the bottoms by 157. The average composition of these rails was:

	Tops.	Middles.	Bottoms.
Phosphorus	0.050	0.057	0.056
Carbon	0.538	0.555	0.565
Sulphur	0.053	0.058	0.058
Silicon	0.071	0.072	0.070
Arsenic	0.050	0.043	0.049
Manganese	0.982	1.020	1.030
Matters other than iron	1.744	1.805	1.828
Difference for iron	98.256	98.195	98.172
Total	100.000	100.000	100.000

There is nothing in the author's judgment in these analyses to account for the great differences in strength. At the beginning of the author's labors in 1894, he must confess to his great alarm on finding how brittle rails were which had broken while in use. The impact of a falling weight is exclusively of the nature of a blow, which, as is well known, differs greatly in its effect from simple pressure. It was ascertained that a rail which broke under a falling weight resisted fracture when placed under hydraulic pressure amounting to 20 tons. Ten rails were operated on, the average fall of the weight to produce fracture being less than one foot.

Government Interference.—There is one difficulty of an important character which railway boards have now to submit to. This lies in the interest taken in their labors by the Board of Trade. In the exercise of their duties, railway companies are forbidden to turn double-headed rails, that is, to reverse them, after one head has suffered the prescribed amount of wear, so as to expose the other head to the traffic. There are certain objections to the plan, unless properly dealt with. This has been effectually done on the North Eastern Railway system, and the result on the main line between Darlington and York attests the accuracy of this statement. On it 883 tons consist of turned rails, the remainder, about 9,150 tons, not having been turned. The average age of the whole at the time the report was made amounted to 20.26 years, and the total loss per yard 6.63 lbs.

The Board of Trade now absolutely refuse to certify a new line as fit for passenger traffic, if it is laid with rails which have been in use on other parts of the line. Such rails may be lifted in the ordinary maintenance of a main line and replaced in the position hitherto occupied. Against this there is not, and cannot be, any prohibition; but their removal to a new situation of insignificant traffic, and consequently small annual wear, is absolutely forbidden.

Molecular Change in Rails by Use.—The former Engineer-in-Chief of the North Eastern Railway system, Mr. T. E. Harrison, in a report prepared for his directors, expressed the opinion that rails by wear became impaired in strength to a degree beyond that due to their mere loss of weight.

Sir William Roberts-Austen and Mr. Stead, of Middlesbrough, have added immensely to our knowledge on this subject by the use of microphotography. The former has ascertained that besides the mere mechanical alteration there is actually a rearrangement of a chemical character in the elements found in the rail, and Mr. Stead has shown that by the crystalline change a direction is given to a cleavage which may end in fracture. This view was propounded before the Institution by Mr. W. G. Kirkaldy in a paper he read in January, 1899, and was commented on by Sir William Roberts-Austen, who exhibited a series of enlarged photographs showing the nature of the various changes. The information then placed at the disposal of the Institution renders further notice by the author unnecessary.

A word or two on a discovery described by Dr. T. E. Thorpe to his fellow-members of the committee appointed by the Board of Trade to inquire into the loss of strength in steel rails through use on railways, of which committee the author was also a member. During the discussions of that body the author adduced certain figures to show that brittleness in a steel rail does not appear to be invariably traceable to a high percentage of phosphorus. In the notes on the evidence afforded by the chemical and micrographical examination of steel rails, by Sir William Roberts-Austen and Dr. T. E. Thorpe, this is substantially agreed to. These gentlemen, as well as other authorities, proceed to show that phosphorus may exist in different forms, one or more of which may be harmless. The author would have a difficulty in making this quite clear to the general reader. He will therefore conclude by an expression of belief that the smaller the total quantity of phosphorus of all kinds, the less will be the chance of having a dangerous amount of the objectionable variety.

For some years railway companies have been called upon to furnish an annual statement of rails which have broken on their lines. The author estimates the number of rails broken annually in service at 1 in 25,000, calculated on all the railways in Great Britain.

Sir William Roberts-Austen, K. C. B., would like to ask a question with reference to the rate of wear in the case of iron and steel respectively. How much d d Sir Lowthian think was due to attrition, and how much to oxidation and corrosion in such cases? Might it not be in the case of steel, which contained carbide and ferrite, that the carbide and ferrite set up an electric couple, which promoted corrosion in the case of steel as compared with iron, and hence the wear was greater? Then again, with reference to the question of turning rails, he had recently examined a great number of worn rails with the microscope, and he found that very many of them had incipient flaws. He considered that it was a highly dangerous practice to turn a rail, but he was bound to say that he had had no practical experience of the wear of rails on a road. Sir Lowthian had referred to the change of structure in rails after prolonged use. He thought Sir Lowthian had in view the mysterious appearance of martensite in the St. Neot's rail, which was thought to be due to a molecular change during the use of that rail. The appearance of that martensite had not as yet been absolutely and satisfactorily explained, for although the result had been closely imitated, the conditions were hardly such as could have obtained in the actual use of the rail on the road. With regard to the point in Mr. Andrews' paper as to the wear of rails in dry tunnels as compared with that in wet tunnels, it seemed to be an interesting suggestion that the water in wet and in badly ventilated tunnels might absorb the corroding gases, and in that way take them out of the sphere of mischief.

Mr. J. C. Inglis (Gt. Western) expressed his feeling that the greater the number of cases one had to deal with the more perplexing, apparently, the problem became. But he thought he might fairly say that one point seemed to crop up now and again from the chaos, viz., that in making steel rails, cleanliness in keeping the rails free from scoriæ and other extraneous matter seemed to be the most important point in obtaining uniformity of strength, even in Bessemer steel. He had had to examine, with the assistance of those who advised him, a large number of cases of fractured rails, where, on testing, the behavior of the steel on both sides of the fracture was found to be entirely satisfactory. Fracture in such cases could only be explained as the result of an incipient flaw. Occasionally there were indications of such a cause; in other cases no indications were found and the cause was assumed. At any rate there was some such cause, which largely detracted from the credit fairly due to Bessemer steel if manufactured with greater attention to the exclusion of foreign matter. He only said that in passing, as it appeared to him to be some little explanation of many of the difficulties which had to be faced in accounting for failures of steel rails.

He quite agreed with Sir Lowthian Bell's remarks as to the Siemens-Martin process, although his experience was small as compared with the author's. But having made a good many experiments, both practically and in the laboratory, he had no doubt of the superiority of that steel. At present the Great Western Railway Company were using it for fittings, and he had not the slightest hesitation in saying that if ever the price of that kind of steel approached the price of Bessemer steel, there would be no hesitation in using it more frequently. By its use a more reliable rail would be obtained, doubtless on account of the longer time which was occupied in its manufacture, so that there was greater power of eliminating defects. An experiment which he had introduced proved that the rail was at once tougher and stiffer than a Bessemer rail, and the fact that his company felt it was quite worth while using a particular sort of steel in fittings—subjected, of course, to a great deal more wear and tear than an ordinary rail—showed that that statement was correct.

He believed that a good many breakages of rails arose from movement of the sleepers—the very cause which was found in that particular instance. Engineers often talked learnedly about the quality of the steel when the fault was in fact inefficiency in maintenance, and he believed that particular cause of fractures would increase instead of decrease as manufacturers went on making rails heavier; at any rate, he felt sure it would so far as the joints were concerned, because the more unbending and rigid the structure became, the more likely it

*Example of estimating aggregate feet of fall of 1 ton required to break a rail:

	Feet.
First blow	5.0
Second blow	5.0
Third blow	7.0
Fourth blow	10.0
Fifth blow	15.0
Sixth blow 21, taken at one-half	10.5
	52.5

was, if there was a deflection in the rail, to get at certain points very severe twists and reciprocating stresses which would produce fracture.

It would appear from Sir Lowthian Bell's paper that the Board of Trade now absolutely refused to certify a new line for passenger traffic if that line was laid with rails which had been in use in other parts of the line. He hoped the Board of Trade would never get to that advanced stage of consideration for public safety. He thought if they did they would be somewhat illogical. At any rate, he would be a sinner in the matter, if the Board of Trade took it into consideration. His company were now making a railway for passenger traffic and goods traffic—it was true it was a light railway—and there the Board of Trade had inserted a clause in the bill providing that worn rails might be used if they were not lighter than 60 lbs. per yard when laid. That was an indication of what the views of the Board of Trade might be about light railways; but he did not think such a regulation as that mentioned by Sir Lowthian Bell would be quite fair. He had a case now, for instance, where, on the main line, with very heavy traffic, the spacing of the sleepers was perhaps wider than he would like it to be. The ballast was not quite satisfactory, and would have to be taken up, and the sleepers required to be re-spaced. The rails were seven years old, and were almost at their best, or, at any rate, in quite good working order. His company might desire to put down a type of road which was adjacent, and might take up those perfectly good rails and the sleepers, and move them to another line less frequented and carrying lighter traffic than the main line; and if the Board of Trade prevented such an operation as that, he thought they would only perpetuate the jolting of the British public in express trains, because, if the Board of Trade would not allow it, the simple result would be that the company would have either to leave the rails until they were considerably more worn, and so perpetuate the unsatisfactory running for a series of years, or to take up the whole at a greater cost, re-space the sleepers, shift their old beds, and produce an unsatisfactory road—at any rate, for the first twelve months after it was laid. He thought the Board of Trade ought not to be encouraged in any such very safe method as was suggested in the paper.

Mr. J. A. McDonald (Midland Railway)— With regard to wet and dry tunnels, he had had a great deal of trouble, as all engineers had, with rails wearing out in tunnels; but, without any exception, the worst tunnels had been the wet ones. He could mention half a dozen notable instances where the tunnel was over a mile long, and in the wet portion of the tunnel the rails had lasted only 3½, 4½ or 5 years, while the rails in the dry portion had lasted nearly double that time. He thought the rapid wear of the rails in those tunnels was due not so much to the actual wear on the face of the rail as to the corrosion all round. Some eight or nine years ago Mr. Francis Stevenson, of the London & North Western Railway, tried the experiment of painting his rails. Mr. Stevenson was kind enough to show him what he had done and the result, and about six years ago he adopted the same system, and now he was painting the rails in all tunnels that were at all wet.

He quite agreed with Mr. Inglis in hoping that the Board of Trade would not make a mistake with regard to prohibiting the use of worn rails, for light railways in particular. Of course, it was known that the Board of Trade "had never made a mistake," and he hoped they would not make a mistake in that instance. The practice was a means of providing, at rather less cost, a very much stronger road than would be provided in any other way. He had a light railway in mind at the present moment, where between eight and ten miles of road were required, and the engineer who was constructing it had asked him to supply worn 85-lb. rails. The Midland Railway Company, of course, did not wear the rails down to the same extent as those mentioned by Mr. Andrews. In his experience, 85-lb. rails in the ordinary main line came out when they weighed about 76 lbs., and rails of 76 lbs. or 77 lbs. that were originally 85 lbs. were very much better than the ordinary 60-lb. rail which would be used for a light railway.

Sir Benjamin Baker, K.C.M.G., thought he might reassure his friends, Mr. McDonald and Mr. Inglis, on the point which had been raised about the views of the Board of Trade on the question of using old rails. One of the first remarks that he had made when he was on the Light Railway Commission of the Board of Trade was to protest against what might be called the definition of a light railway as a railway which had a certain limited weight on the driving wheel or which had light rails. He said if there was to be any extensive introduction of light railways it could only be through the help and assistance of the leading railway companies, and questions of economy would be the first consideration. Therefore, one of the very first conditions would be that the railway companies should be able to take out their old rails and use them for light railways, and should be able to take their old rolling stock and engines which were obsolete for main line service and put them on light railways. There was not a word of protest from any of the Board of Trade officers present, and he did not think any fear need be felt about putting the old rails of main lines on light railways. It would be regarded as a common sense matter which all Englishmen, including the Board of Trade, would accept as proper.

Mr. Richard Johnson was very glad to find that the Board of Trade objected to turning rails. That objection had been sustained, as might be remembered, by a very bad illustration of the effects of turning rails between Tunbridge Wells and Tunbridge. He was very glad to know that that practice had been stopped. His old friend, Mr. Brady, had been very fond of turning rails. He had always told him he was wrong, and he was still of the same opinion. Sir Lowthian Bell had mentioned the fact of rails being turned upon the North Eastern Railway, but there Mr. Thomas Elliot Harrison had adopted a cushion, and that helped very much to save the rail before it was turned. He thought Mr. Copperthwaite had continued the practice until he had put into work the bull-headed rail. He was very glad to learn from Mr. McDonald that he had adopted a plan of painting the rails in tunnels, as he believed he would find it very successful.

Mr. F. E. Robertson wished to ask one question on which Sir Lowthian Bell's opinion would be valuable. There was an impression abroad, which was found reflected in the American journals, that steel rails as made within the last few years were much softer than they used to be, that they showed signs of wear, and wore out sooner, especialy at points and crossings. Where there was so much smoke there was probably some fire, but he did not know that the fact of the rails being softer had ever been established. He had asked some of the men in India who complained of the rails being too soft to send samples home so that experiments might be made to test their physical hardness. Assuming that they were softer, it was scarcely probable that rails made under the same inspection and to the same specification were softer on chemical grounds, and the reason was therefore to be sought in the process of manufacture. There was no question, he believed, that in former days the ingots were much more gently treated, and the rails were rolled more easily and finished at a much lower temperature. Nowadays an ingot was stripped as soon as it could stand upright, it was hauled off to the soaking pits, and it went through the rolls and was turned into a rail at as high a temperature as it could stand at. What he would like to ask Sir Lowthian Bell was, whether it was not possible that the great speed at which the work was done now, and the higher temperature throughout under which the rails were finished, might be the cause of their softness at the present day.

Sir Lowthian Bell, Bart., would like to say one word on the subject of the two processes of making rails, the open-hearth and the Bessemer. In the latter process something like 15 tons or 20 tons of metal was run into the converter, and in less than as many minutes it was converted into steel. It was idle, therefore, to talk of making any examination of the condition of the contents of the ingots where the time was so short; whereas, with the open-hearth furnace a very different state of things prevailed. Practically it might be said that the charge was in the open-hearth furnace for nearly 10 hours, and the practice was to take out a certain quantity of steel, beat it under the hammer into a flat plate and then bend it. It was then a circular plate, and was bent a second time when cold. Unless it stood that test without breaking, the product would be rejected. The workmen by experience could read the lesson that was taught them, and there was opportunity in the open-hearth process, from the length of time during which the operation lasted, to introduce modifications. If the product was deficient in carbon, carbon could be added, or if it was too high in carbon or sulphur, those things could be corrected in the furnace itself before the product was run into the ingot moulds and formed into steel. He was very hopeful, indeed, that the day would come when, in order to secure a rail of uniform quality and of the highest possible strength, the railway engineer would specify that all rails should be made in the open-hearth furnace.

Mr. J. E. Stead considered it a great triumph in metallurgical research when Professor Arnold proved that the sulphur in steel, or at least the greater part of it, separated out in combination with iron or manganese, and did not remain in combination with the mass of the steel in the way phosphorus did, but was thrown out of solution and appeared as envelopes to the crystalline grains of steel under certain conditions. Mr. Stead had noticed they were more usually in the form of minute globules in large ingots. When the steel ingots were rolled out into rails, these globules were elongated and appeared in longitudinal section as lenticular forms; but in reality, as he had shown in a paper on the causes which tended to produce fracture in iron and steel, they were of torpedo or cigar shape. When the original section of the ingots was greatly reduced, these sulphide globules were rolled out and became elongated threads. He had observed that they were usually quite separated one from the other. From an engineer's point of view, they were not more harmful than cinder or any other non-metallic foreign matter. When this discovery was clearly established, it came as a great relief to his mind, for now it was proved that the sulphides were only mechanically mixed, and were not chemically combined with the cold steel. He would like to ask Mr. Andrews if he considered that he had clearly and logically proved that the separated sulphides were responsible, in any way, for the wear of the rail he examined.

Mr. Andrews' results would tend to remove from engineers' minds the lurking fear that sulphur was a great evil in structural material, for here was an excellent rail with 0.12 per cent. of sulphur in it, which had been subjected to the worst possible conditions and treatment, yet it came through the ordeal triumphantly, and did not show any deterioration in its mass after seven years' percussive and vibratory stresses. Sulphur, in excess, usually made steel redshort, and rails unfit to send out of the maker's works. Manufacturers, in their own interest, aimed at keeping that element within limits, and with such success that during the last few years they had greatly reduced the proportion of wasters by adopting methods of keeping the sulphur down. Mr. Stead's experience was that, provided the rails were sound and were free from visible flaws, about 0.1 per cent. sulphur did not appear to cause rapid wear or produce fracture, and he did not think Mr. Andrews had proved that the reverse was the case.

Mr. T. Andrews remarked, in reference to Mr. J. E. Stead's question whether the separated sulphides had been responsible in any way for the wear of the rail, that he had stated in the paper that the wear of the rail had been due principally to the heavy amount of work put upon it; and after having carefully studied the structure of the rail, he considered further that the peculiar way in which the sulphides of iron and of manganese had micro-segregated in many places in this rail had undoubtedly intensified the effects of the heavy wear. Mr. Stead inferred that the sulphides in steel rails were isolated, and therefore mechanically harmless. This was often the case, but he had noticed in various other instances, both in fractured steel rails examined by him for various railway companies, and in fractured propeller-shafts and other forgings, that the sulphides, in a more or less attenuated condition, were not infrequently locally connected in various parts of the mass of the steel, and hence destroyed for appreciable distances that metallic contact between the ultimate crystals of the metal which was essential to ensure permanent strength. Mr. Stead suggested to engineers that 0.10 per cent. of sulphur was not detrimental to steel rails. It should, however, be pointed out that such a high percentage would allow makers to use a commoner quality of pig iron than was desirable for good rail steel. He had found no difficulty in obtaining rails not containing more than 0.07 per cent. of sulphur. He had examined for railway companies rails with a comparatively high percentage of sulphur, some of which had worn down badly and had had comparatively short lives, whilst others from the same cause had actually fractured in service. He was sorry Mr. Stead attempted to minimize the evil effects of sulphur in steel rails, as it was evident that the less of such a "deadly enemy" (as Professor Arnold styled it) or impurity there was present in rails the greater their endurance would be, and Mr. Stead's advocacy of so high a percentage of sulphur as 0.10 in steel rails would appear to be detrimental to the interests of the public safety.

Communication Between New York and Brooklyn.

Mr. O. F. Nichols, Principal Assistant Engineer of the New East River Bridge, in a recent lecture before the Brooklyn Institute stated several facts about communication across the East River with considerable vigor. Among other things he said:

The New York and Brooklyn Bridge was opened early in 1884 and it was fully believed in 1886 that its railway was greatly overcrowded. Since that time the railway travel on the bridge has increased five-fold, and to-day the most disgraceful and demoralizing scramble for standing room on passenger cars visible in the wide world, may be witnessed any evening at the Manhattan terminal. This bridge has never been the highway between the cities which was intended by the builders and is to-day quite as inconvenient and dangerous for carriages and teams as it is for railway purposes. No such stream of humanity have been hurled in the face of crowded vehicular travel since the days of Juggernaut as daily land from the bridge cars onto Park Row, and never before has the world witnessed daily, such a block of passenger vehicles or waste of valuable time therefrom as results from the miles of stagnated travel incident to the block of cars to and from the bridge on Fulton street.

Now, what is the prospect of relief from these terrors which beset us? The New East River Bridge will be completed in two or three years and should well serve that portion of Brooklyn east of Washington avenue, but it cannot materially relieve the cruel crowding on the old bridge. Of the two newer municipal bridges, No. 4, or the Blackwell's Island Bridge, will furnish a valuable highway for the somewhat distant figure; No. 3, or the bridge from Washington street, will provide a practical extension of Flatbush avenue to the Bowery and Canal street in Manhattan. This bridge should have been commenced years ago, and should be completed at the earliest possible moment. This bridge is now our one hope of satisfactory relief from conditions repulsive alike to our senses and our intelligence. He who lays so much as a feather's weight of obstruction in its way will well deserve and may expect the execration of contemporaries and the dire maledictions of posterity.

For further relief from present conditions we are advised that the Manhattan subway will be extended to Brooklyn by tunnel, and it is hinted that something like $8,000,000 is in some way available for this purpose; I have no special quarrel with this subway; it has locked up $36,000,000, half of which would, in my judgment, be better expended on bridge No. 3; the amount of the other half would have furnished an amplification and enlargement of the elevated railway system of Manhattan, which would accomplish more for real rapid transit in Manhattan than can be reasonably hoped for from the subway.

A tunnel to Brooklyn was practically assured, and would, I believe, have been built but for, among other things, the limit to the life of a franchise fixed by the charter and the prospect that the city would ultimately do this work, which properly belongs to the realm of private enterprise.

Underground railways have always been expensive and have seldom been very satisfactory in handling great masses of passengers at high speeds. The first underground railways were quickly utilized by the surface steam railways for their

city connections. The size of the tunnels favored, if indeed it did not invite this result. The Manhattan subway and its proposed adjunct, the tunnel to Brooklyn, will in all probability meet a similar fate and become a most valuable acquisition to the trunk line railways. This is as it should be, for where better than underground can these lines make these connections and reach the terminals so essential to a satisfactory accommodation of their great urban constituencies? I do protest, however, that it is wrong to lend the limited borrowing capacity of this great city to corporations abundantly able and doubtless willing to do the work themselves, and especially if this is done to the hindrance or neglect of more essential work of a character necessarily of public care and benefit.

It is claimed that tunnels can be built across the East River cheaper and quicker than bridges. The first statement is only qualifiedly true and the second is not proven. No such tunnel as the one proposed can be used for ordinary vehicles, nor can several tunnels equal the railway capacity of one great bridge. If bridge No. 3 were to be pushed it could be completed before the subway or the tunnel will be ready for use, and it would easily accommodate threefold more people than the tunnel, and beside furnish that which no tunnel or tunnels can ever furnish, a great, broad highway between the busy sections of the two great boroughs and thereby materially increase the population and enhance the comfort and wealth of this particular borough.

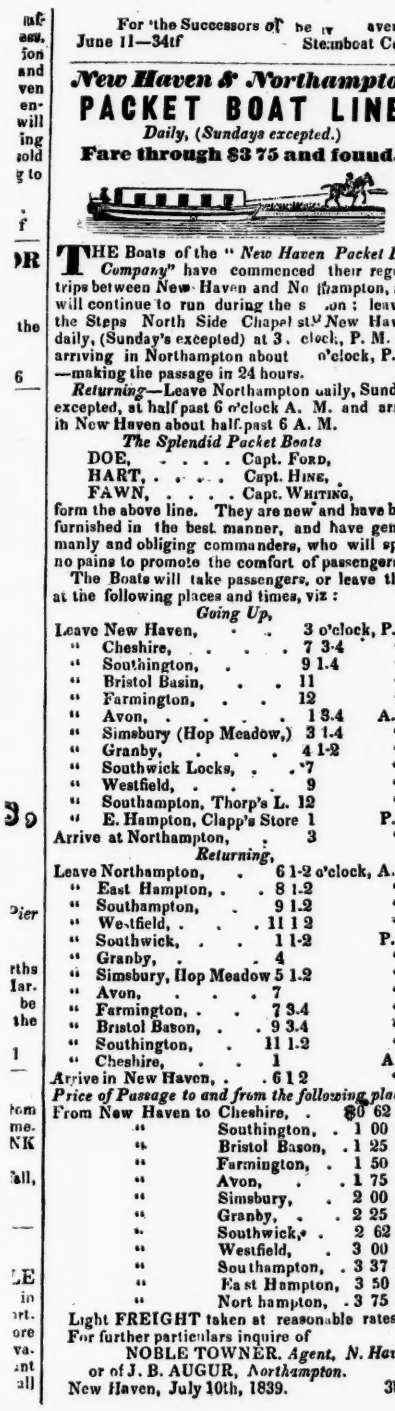
74 Miles in 24 Hours.

The notice of the New Haven & Northampton Packet Boat Line, which appears on this page, is a fac simile of part of one of the advertising columns of a Connecticut newspaper of 1839. It is shown here as an interesting scrap of the transportation history of the first half of the last century.

The line of the canal from New Haven, Conn., to Northampton, Mass., was substantially the same as that now traversed by the New Haven & Northampton Railroad, which is the Northampton Division of the New York, New Haven & Hartford, though there were in the canal numerous sharp curves which would have proved too much for even the agile locomotives of the old Canal Railroad. We do not know the exact length of the canal, but the distance between the two cities by the present railroad line is 74 miles, so that, as will be seen by the time-table shown in the advertisement, the boats made the very lively speed of three miles an hour and perhaps a trifle faster. This includes, of course, a good deal of time used up at locks and in meeting freight boats.

As the passengers were "found," however, we may assume that the delays were not irksome. "Findings" probably included both wet and dry refreshments. Not all of the scenery along the line can be classed as fully up to the White Mountain standard, but there was, no doubt, a good variety of game available for such passengers as carried guns, thus affording agreeable diversion.

This relic was sent to us by Mr. R. G. Curtis, of Westfield, Mass., who is one of the veterans of the New Haven & Northampton Railroad, having begun his service on the line as express messenger in 1855 soon after the railroad was opened through to Northampton. In 1861 he began running as conductor on the Massachusetts part of the line, then the Hampshire & Hampden Railroad, and in 1869, when the operations of this and the Connecticut part of the line (originally the Farmington Canal Railroad) were consolidated, he ran through from New Haven to Williamsburgh. Since 1871 Mr. Curtis has been either Assistant Superintendent or Superintendent of the road, with office at New Haven. On the consolidation of this division with the Air Line Division, at the beginning of the present year, Mr. Curtis' office was moved to Westfield.



For the Successors of the New Haven Steamboat Co.
June 11—34tf

New Haven & Northampton
PACKET BOAT LINE.
Daily, (Sundays excepted.)
Fare through $3 75 and found.

THE Boats of the "*New Haven Packet Boat. Company*" have commenced their regular trips between New Haven and Northampton, and will continue to run during the season; leaving the Steps North Side Chapel st. New Haven, daily, (Sunday's excepted) at 3 o'clock, P. M. and arriving in Northampton about o'clock, P. M. —making the passage in 24 hours.

Returning—Leave Northampton daily, Sundays excepted, at half past 6 o'clock A. M. and arrive in New Haven about half past 6 A. M.

The Splendid Packet Boats
DOE, ... Capt. FORD,
HART, ... Capt. HINE,
FAWN, ... Capt. WHITING,
form the above line. They are new and have been furnished in the best manner, and have gentlemanly and obliging commanders, who will spare no pains to promote the comfort of passengers.

The Boats will take passengers, or leave them at the following places and times, viz:

Going Up,

Leave New Haven,	3 o'clock,	P. M.
" Cheshire,	7 3-4	"
" Southington,	9 1-4	"
" Bristol Basin,	11	"
" Farmington,	12	"
" Avon,	1 3-4	A. M.
" Simsbury (Hop Meadow,)	3 1-4	"
" Granby,	4 1-2	"
" Southwick Locks,	7	"
" Westfield,	9	"
" Southampton, Thorp's L.	12	"
" E. Hampton, Clapp's Store	1	P. M.
Arrive at Northampton,	3	"

Returning,

Leave Northampton,	6 1-2 o'clock,	A. M.
" East Hampton,	8 1-2	"
" Southampton,	9 1-2	"
" Westfield,	11 1-2	"
" Southwick,	1 1-2	P. M.
" Granby,	4	"
" Simsbury, Hop Meadow	5 1-2	"
" Avon,	7	"
" Farmington,	7 3-4	"
" Bristol Bason,	9 3-4	"
" Southington,	11 1-2	"
" Cheshire,	1	A. M
Arrive in New Haven,	6 1-2	"

Price of Passage to and from the following places.

From New Haven to Cheshire,	$0	62 1-2
" Southington,	1	00
" Bristol Bason,	1	25
" Farmington,	1	50
" Avon,	1	75
" Simsbury,	2	00
" Granby,	2	25
" Southwick,	2	62 1-2
" Westfield,	3	00
" Southampton,	3	37 1-2
" East Hampton,	3	50
" Nort hampton,	3	75

Light FREIGHT taken at reasonable rates.
For further particulars inquire of
NOBLE TOWNER. *Agent, N. Haven,*
or of J. B. AUGUR, *Northampton.*
New Haven, July 10th, 1839. 38

Massachusetts Railroad Commissioners' Report.

The annual report of the State Railroad Commissioners of Massachusetts, so far as it dealt with standard railroads, was noticed in the *Railroad Gazette* of Feb. 8. The Commissioners have now issued advance sheets of Part 2, giving their report on street railroads, which, according to legislative precedent, are in Massachusetts always called "railways."

The annual reports of the street railway companies for the year ending Sept. 30, 1900, show 1,913 miles of line, of which 178 miles was built during the year. The length of double track line is 251 miles and, with side tracks, the total length of track is 2,038. Twenty-two miles of line lies in the State of Rhode Island. The number of companies reporting is 118.

The report gives in detail the additions to stock and bonds during the year. The principal financial and traffic statistics are as follows:

Street Railroads in Massachusetts, 1900.

		Per mile of main track.
Capital stock	$48,971,168	$44,273
Funded debt	34,373,000	
Other liabilities	252,470	
Cost of road, equipment and real estate	83,497,941	43,637
Other assets	15,202,134	
Income	21,387,641	10,452
Operating expenses	13,159,947	6,878
Interest	1,782,797	
Taxes	1,347,119	
Other expenses	2,060,276	
Dividends	2,409,874	
Surplus	627,628	
Passengers carried	395,027,198	200,262
Number of employees	12,766	
Number of cars	6,531	
Number of other vehicles	2,371	
Number of horses	455	
Electric motors	9,545	

Eighteen passengers, 3 employees and 48 other persons were killed on the street railroads during the year and 1,695 passengers, 84 employees and 756 other persons were injured.

Under a law passed in 1899 Mr. George F. Swain, Bridge Engineer of the Commission, now has supervision of street railroad bridges. His report shows that there are 200 such bridges in the state, including pile bridges, wooden trestles, steel trestles, wooden stringers, trussed wooden stringers, wooden trusses, I-beams, plate girders, riveted trusses, pin-connected trusses and four movable bridges. The total number of wooden bridges is 89, aggregating 20,000 ft. in length; of metal 111, aggregating 8,362 ft. Eighteen street railroad bridges are in process of construction. After extensive inquiry and investigation Mr. Swain has prepared the following specifications for street railroad bridges, which have been provisionally adopted by the Board:

The standard loads to be used are a 20-ton, 4-wheel car, with a wheel base of 7 ft., or a 30-ton 8-wheel car, with a total wheel base of 17 ft. and a truck wheel base of 4 ft. The floor system of bridges is to be proportioned for these loads, together with the dead load. Main girders and trusses are to be proportioned for a uniform load per running foot, depending upon the length which has to be loaded to produce the maximum stress in any part. The load to be assumed varies from 1,500 lbs. per linear foot per track for spans or loaded lengths up to 100 ft., down to 1,000 lbs. per running foot per track for loaded lengths of 300 ft., and proportionally for intermediate lengths. If the concentrated loads previously specified give greater stresses in any parts, these concentrated loads must, of course, be used. The fiber stresses adopted provisionally are as follows: On I-beams, 12,000 lbs. per sq. in., reduced if necessary according to ratio of length to width of flange; on plate girders for floor beams or longitudinal girders, 12,000 lbs. in tension and 12,000 lbs. in compression, the latter reduced as before if necessary. Shearing on webs to be 10,000 lbs. and on rivets 10,000 lbs., and bearing to be 16,000 lbs. The above stresses on rivets to be reduced 25 per cent. for field-driven rivets. On trusses, 15,000 lbs. in tension and 12,500 lbs. in compression. Rivet stresses the same as previously specified.

The above specifications are for medium steel. More complete specifications are in preparation, and these figures may be somewhat modified.

Mr. E. K. Turner, Consulting Engineer of the Board in connection with the elevated railroad which is being built in Boston, makes a report of five pages, showing what has been done on that road and the present state of the work. This report is dated Jan. 9. It shows that 70 per cent. of the steel structure is finished, 30 per cent. of the rails laid and that seven stations are in course of construction. The powerhouse and principal car house are nearly done.

The Commissioners recommend a few changes in the laws governing street railroads. There has been some demand for a general revision of all the statutes on this subject, the existing statutes being somewhat confused and inconsistent; but the Commissioners do not think the time has come for a radical revision. The Adams Commission of 1898 recommended such changes as were at that time thought necessary and some of them were carried out by the Legislature; these ought to be tried a while longer before making additional changes. That Commission decided that a street car is essentially an omnibus and the track essentially a part of the street; this principle is sound and should govern the action of the state. The street railroad should work with the steam railroad, not as a substitute for it. It should not attempt to rival the speed of the railroad train. As a rule the Commissioners believe that freight should not be carried on street railroads. By a law of 1898 the Commissioners have power to reduce street railroad fares which are found to be higher than the average charged by other companies for similar service. It is hard, however, to decide what is "similar service" and the Commissioners recommend that, if they are to have power to reduce fares they be subject to no limitation except that of reasonableness. The board recommends that the state require new street railroads to be inspected before being opened for business and that a signal system be required on single track street car lines.

The "anti-stock-watering laws" of the state are declared to be useful. They protect the public from the evils of over-capitalization, and the ability of the companies to borrow money at moderate rates indicates that the capitalist is not unfavorably affected. During the past year the board has approved the issue of 14½ millions of street railroad stock and four millions of bonds. Petitions for about $800,000 of stock and $119,000 in bonds were refused. The Commissioners warn the Legislature not to exempt companies from these wholesome laws with out careful inquiry.

Complying with an order of the Legislature the Commissioners have made a special report on the propriety of making street railroads pay a part of the cost of the abolition of grade crossings (in cases where such a company uses the crossing). It is recommended that the special commission of three persons which, under the law, apportions the expense of each crossing change, shall have power to apportion a share to the street railroad. Such share being determined, the remainder of the cost should be apportioned to the steam railroad, to the town and to the state in the same proportions as heretofore, namely, 65 per cent., 10 per cent. and 25 per cent. respectively. It has been claimed that street railroads should not be made to pay, because they do not have a permanent right to the use of streets. In theory this is true, as the "location" may be revoked at any time; but practically there is no danger that any city or town will revoke such a right except to punish a company for reckless or arbitrary management. Investors have confidence in the safety of street railroad investments in spite of the insecure titles, as appears from the good prices which they pay for stocks and bonds. The proposition that the law should provide for paying back a part of the contribution of the street railroad company, in the event of its location being revoked, is disapproved. The Commissioners believe that there is no real demand for such a provision in the proposed law. Street railroads have in many cases been required to make substantial improvements in the streets when building new track, often at considerable expense, but no company has ever asked for a promise of reimbursement in case it should go out of business.

Foreign Railroad Notes.

In Alsace, last June, trains were seriously obstructed by accumulations of a certain kind of worm on the tracks. These creatures, 1 to 1½ in. long, near sunset, crept upon the track over a section more than half a mile long, and when night came on remained on the rails in heaps sometimes 2 in. thick. For a week trains were often stopped by them, and in one case it was necessary to divide a freight train and forward it in two sections, the track was so slippery. "Julus terrestris" is the name of the beast, which is a near relation of the tropical centipede. Of course, our readers know all about grasshoppers stopping trains.

The through train for the one-lunged, as they used to say in California, was put on between St. Petersburg and Nice (and Cannes) Nov. 15. It runs once a week, going by way of Warsaw, Vienna, and Verona, with a through sleeping-car and a dining car on suitable parts of the route. The time, St. Petersburg to Nice, is 69½ hours. St. Petersburg to Vienna, 37¼ hours.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advetising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Train Accidents in 1900.

The number of passengers killed in train accidents during the last calendar year (112) is just about the same as the number shown in our report for 1899; but the number of employees killed increases with the increase of business, so that the total number of fatalities is larger than in any year since 1893. Comparisons more in detail are not satisfactory, for the reason that in the years 1894-97 the number of trains run was much less than in the years before and after that period, but if our usual comparison of casualties for seven years be supplemented by a brief statement for the years back to 1887, it will be seen that progress has been made. It is regrettable to have to report a constant increase in the number of persons killed each year from 1897 to 1901; but the highest figure shown here is below the lowest shown for '87, '88, '90, '91, 92, or '93; and this decrease has been effected in spite of an increase in the number of miles of railroad. For the years under consideration the totals mentioned appear as follows:

Casualties, Fourteen Years.

	Persons killed.	Persons injured.	Train mileage, millions.	Persons killed per million train miles.
1887	656	1,946	644.0	1.018
1888	667	2,204	688.8	0.968
1889	492	1,772	622.0	0.681
1890	806	2,812	793.9	1.015
1891	700	2,685	831.2	0.950
1892	672	2,407	864.9	0.777
1893	691	2,584	889.4	0.777
1894	442	1,343	818.4	0.540
1895	415	1,535	834.2	0.497
1896	540	1,297	850.7	0.646
1897	417	1,472	858.0	0.485
1898	426	1,701	905.0	0.651
1899	589	2,061	910.5	0.702
1900	639	2,123	....	....

The encouraging feature is the improvement shown in the last column; though it is still evident that the progress of this improvement is materially retarded whenever a sudden increase of business compels the railroads to employ inexperienced men.

The large table, No. 1, is made in the same form as in previous years, and is self-explanatory. It is perhaps unnecessary to explain that our monthly records, here summarized, are based primarily on information gathered from the local press throughout the country, there being, of course, no pretense of completeness. In the majority of items the facts are given as we find them reported, but with inaccurate or exaggerated statements eliminated. In the cases of the more prominent accidents, especially those in which passengers are killed, or where the details of the occurrence or an explanation of the causes will be interesting or instructive to railroad men, the report is verified by inquiry of the superintendent of the road involved. The classification of the causes of the accidents is somewhat arbitrary and where two or more causes combine to produce an accident, the case is classified according to the principal cause.

For the year 1900 we had to record two passenger train accidents which caused the death of more than 10 persons each. These were the wreck due to a washout at McDonough, Ga., in June, where 32 persons were killed, and the rear collision at Hatfield, Pa., in September, killing 13 passengers. But though only two cases were thus prominent (there were two in 1899 also; but none so bad in 1898) there were startling and very costly accidents in every month of the year, except perhaps in October; and in that month the number of persons killed rose to 74, an unusually high figure. Our first record in 1900 (January) was marked by a terrific explosion due to a freight train collision at Ashley, Pa. In February occurred the Terre Haute bridge wreck, and on the Northern Pacific in Montana a whole freight train was destroyed in a mountain runaway. In March there was a passenger train wreck at Altoona and the April record included notable cases at Bristol, Pa., Magenta, Tex., and York Harbor, Me. In May the Jenkintown (Pa.) wreck was the worst; and in June came the McDonough disaster, already mentioned. If, in this case, there had been one less car in the train, there would probably have been no living person left to report the tragedy.

The worst train accident in July was a runaway in California similar to that in Montana, mentioned above; but the month was marked by a street car disaster (at Tacoma) in which forty persons were killed. In August nine persons were killed in one collision, and in the month following 22 passengers were killed in two accidents. One of these, the rear collision at Hatfield, Pa., killing 13, was notable in its cause and its results. October has already been mentioned. In November occurred the derailments at Beaver, Pa., and Bailey's, Pa. In December one colli-

TABLE NO. 1.—TRAIN ACCIDENTS—THEIR NATURE AND CAUSES FOR TWENTY-EIGHT YEARS.

	1900.	1899.	1898.	1897.	1896.	1895.	1894.	1893.	1888-92. †	1883-87. †	1878-82. †	1873-77. †
Train Mileage in United States in millions of train miles*	925.0	910.5	905.0	858.0	850.7	834.2	818.4	889.4	...	...	...	...
Collisions:												
Rear	419	489	473	355	228	301	280	455	464	342	275	150
Butting	227	246	232	158	129	109	134	223	286	174	121	96
Crossing and miscellaneous	489	406	307	218	157	192	199	318	209	32	21	44
Total collisions	1,135	1,141	1,012	731	514	602	613	996	959	548	417	295
Derailments:												
Broken rail	30	22	19	25	26	42	32	71	49	68	48	71
Loose or spread rail	31	26	26	23	16	16	35	57	47	66	34	31
Broken bridge or trestle	37	20	21	26	19	16	23	20	38	32	27	24
Broken or defective switch	19	20	17	13	9	9	16	41	27	13	3	9
Broken or defective frog	6	4	6	8	3	5	5	16	11	11	2	5
Other defects of road	16	6	5	6	5	8	3	9	3	1	2	9
Total defects of road	139	98	94	101	78	95	114	214	175	191	116	149
Broken wheel	86	59	51	42	42	33	33	48	40	33	28	22
Broken axle	95	111	113	77	74	70	71	88	55	49	36	32
Broken truck	45	31	36	30	24	20	18	31	28	15	11	10
Failure of coupling or drawbar	22	34	28	28	16	17	27	29	13	4	1	4
Fall of brake-beam	16	16	14	14	9	14	20	19	16	5	..	3
Automatic application of air-brakes	12	12	..	..	..	..	..	..	..	..	..	..
Same, due to failure of drawbar	5	6	..	..	..	..	..	..	..	..	..	..
Other defects of equipment	20	31	28	23	23	23	23	26	18	2	3	5
Total defects of equipment	301	300	270	214	188	177	182	241	170	108	79	76
Misplaced switch	65	38	42	39	28	48	53	67	71	69	77	76
Derailing switch	13	14	13	9	5	7	..	..	..	..	..	..
Negligence of tr'kmen or bridgemen	10	12	8	4	2	8	6	14	8	5	5	8
Runaway engine or train	28	9	16	14	6	8	1	4	10	2	2	2
Open draw	2	3	2	6	2	3	4	4	3	4	3	4
Too quick application of air-brake	7	6	..	..	..	..	..	..	..	..	..	..
Other negligence	58	48	25	19	23	17	39	48	32	5	4	6
Total negligence in operating	183	130	106	91	66	91	103	137	124	84	91	97
Animals on track	29	28	25	23	24	21	38	50	53	33	39	48
Snow or ice	6	2	10	8	9	16	12	16	9	17	13	20
Washout	27	21	9	21	23	17	5	16	19	21	21	28
Landslide	42	32	17	20	29	25	31	27	29	16	7	6
Accidental obstruction	21	25	19	21	26	33	19	32	21	32	32	38
Malicious obstruction	31	22	9	18	28	40	62	51	39	30	13	15
Other unforeseen obstructions	2	6	8	3	7	2	11	5	8	8	3	3
Total unforeseen obstructions	158	136	97	114	146	154	178	197	178	157	128	158
Others	...	...	...	...	...	...	...	...	...	...	1	5
Unexplained	652	563	577	353	314	293	296	423	384	184	231	224
Total derailments	1,433	1,227	1,144	873	792	810	873	1,212	1,031	723	646	709
Accidents without collision or derailment:												
Boiler explosions	11	19	19	11	15	12	9	24	17	15	14	10
Broken parallel or connecting rod	8	12	8	13	6	10	12	8	11	22	14	10
Cars burned while running	26	11	10	10	4	17	16	18	12	10	8	9
Various breakages of rolling stock	7	8	16	3	12	8	10	18	24	21	9	16
Other causes	26	13	19	17	14	28	27	31	29	8	4	6
Total without collis. or derail	78	63	72	54	51	75	74	99	93	76	46	51
RECAPITULATION.												
Collisions	1,135	1,141	1,012	731	514	602	613	996	959	548	417	295
Derailments	1,433	1,227	1,144	873	792	810	873	1,212	1,031	728	646	709
Other accidents	78	63	72	54	51	75	74	99	93	76	46	51
Total	2,646	2,431	2,228	1,658	1,357	1,487	1,560	2,307	2,083	1,347	1,100	1,055

*Train mileage is taken from Poor's Manual, which gives revenue mileage only; that for 1900 is estimated.
†Average per year for five years.

TABLE NO. 2.—CASUALTIES TO PASSENGERS AND EMPLOYEES IN TRAIN ACCIDENTS IN 1900.
Tabulated according to classes of causes.

Month—	Defects of road. Pass. Killed.	Pass. Injured.	Emp. Killed.	Emp. Injured.	Defects of equipment. Pass. Killed.	Pass. Injured.	Emp. Killed.	Emp. Injured.	Negligence in operating. Pass. Killed.	Pass. Injured.	Emp. Killed.	Emp. Injured.	Unforeseen obstructions and maliciousness. Pass. Killed.	Pass. Injured.	Emp. Killed.	Emp. Injured.	Unexplained. Pass. Killed.	Pass. Injured.	Emp. Killed.	Emp. Injured.	Total. Pass. Killed.	Pass. Injured.	Emp. Killed.	Emp. Injured.
January	0	3	0	2	0	0	0	5	3	56	17	65	0	0	3	10	0	0	2	4	3	59	22	86
February	0	5	2	1	2	15	0	4	14	31	29	82	0	4	5	9	0	10	2	9	16	65	38	105
March	0	3	6	5	0	0	3	0	5	64	10	32	1	19	6	13	1	18	3	11	7	104	28	61
April	0	21	8	4	0	3	1	3	3	13	8	44	0	1	6	18	0	11	8	24	3	49	31	93
May	0	0	4	6	0	2	8	8	0	21	17	50	0	5	4	6	1	2	3	16	1	30	36	86
June	1	24	2	6	0	0	2	15	5	48	22	50	17	18	21	14	0	3	3	7	23	93	50	92
July	0	9	0	6	1	6	5	8	2	24	13	55	2	46	4	10	1	14	6	28	6	99	28	107
August	0	2	4	10	0	5	1	1	4	34	25	63	0	6	2	13	1	13	3	10	5	60	35	97
Sept'ber	0	3	4	1	11	16	1	3	13	35	21	65	1	13	3	6	1	32	2	3	26	99	31	78
October	8	12	2	6	0	17	2	12	4	9	27	71	0	7	15	18	1	6	10	9	13	51	56	116
Nov'mb'r	0	1	0	8	0	3	0	2	4	47	34	108	0	3	4	14	0	10	8	16	4	64	46	148
Dec'mb'r	0	1	5	6	3	3	3	10	1	28	37	97	0	10	2	5	1	27	4	12	5	69	51	130
Year	9	84	37	61	17	70	26	71	58	410	260	782	21	132	75	136	7	146	54	149	112	842	452	1,199
Year '99	4	117	16	42	4	51	40	90	87	439	244	727	9	90	50	93	9	191	52	143	113	888	402	1,095
Year '98	4	44	19	68	1	36	33	68	19	287	175	680	6	92	42	62	16	157	56	146	46	616	325	1,024
Year '97	2	92	27	45	7	95	27	58	28	293	137	451	4	52	47	69	21	100	38	104	62	632	276	727
Year '96	11	144	22	42	0	32	48	41	89	310	154	349	23	97	59	84	5	35	35	85	128	618	318	601
Year '95	2	106	16	69	4	52	30	73	17	378	157	415	6	43	46	100	9	122	53	82	38	701	302	739
Year '94	3	33	23	70	5	19	24	56	127	202	136	462	16	95	61	145	7	61	36	112	58	410	280	845
Year '93	15	336	32	121	3	64	47	75	52	634	243	742	1	56	156	167	7	150	46	138	78	1,240	424	1,243
Year '92	23	322	39	103	2	85	66	93	178	514	271	718	5	88	72	177	8	117	47	113	116	1,126	490	1,204
Year '91	24	291	45	101	7	90	42	65	114	458	345	939	23	116	57	154	9	228	61	188	177	1,183	550	1,447
Year '90	19	195	61	126	4	86	30	77	15	624	337	959	24	103	60	165	10	216	81	192	172	1,224	569	1,519
Year '89	16	167	30	81	7	58	24	63	46	291	189	595	34	107	53	120	5	122	40	119	108	745	336	978
Year '88	5	195	45	153	16	65	35	92	92	388	217	573	11	106	77	163	44	258	60	117	168	1,012	434	1,098

sion killed nine persons, and two others helped to swell the list of failures under the block system.

	1900.	1899.	1898.	1897.	1896.	1895.	1891.
Pass'gers killed..	112	113	46	62	128	38	58
Empl'ees killed..	452	402	325	276	318	302	280
Others killed ...	75	74	55	79	94	75	104
Total killed ..	639	589	426	417	540	415	442
Pass'gers inj'ed..	842	888	616	632	618	701	410
Empl'ees inj'ed..	1,199	1,095	1,024	727	601	739	845
Others injured...	82	78	61	113	78	95	88
Total injured...	2,123	2,061	1,701	1,472	1,297	1,535	1,343
Train mileage, millions*	...	910.5	905.0	858.0	850.7	834.2	818.4
No. persons killed per million train miles	...	0.702	0.651	0.485	0.646	0.497	0.540

*Estimated.

The relative frequency of the more prominent causes of collisions for six years past is shown in the following table:

	1900.	1899.	1898.	1897.	1896.	1895.
Train breaking in two.	111	151	143	155	93	96
Misplaced switch.....	86	87	63	48	51	42
Failure to give or observe signals	116	98	115	58	33	64
Mistake in giving or understanding orders..	52	70	47	33	48	35
Miscellaneous	220	240	246	149	99	117
Total explained	585	646	614	443	324	354
Unexplained	550	495	398	288	190	240
Total	1,135	1,141	1,012	731	514	602

The total number of casualties to persons recorded during the past seven years is shown by years in the following table:

The number of street railroad accidents in 1900 was larger than in any previous year of our record, as will appear from the following table:

Street Railroad Accidents.

	1900.	1899.	1898.	1897.	1896.	1895.	1894.
Accidents	189	181	133	108	182	117	61
Persons killed....	87	66	27	31	37	45	8
Persons injured..	868	534	378	355	545	298	100

No satisfactory averages can be computed from this table, for the reason that the mileage of street railroads has increased very fast. The year 1899, like 1900, was marked by a notable disaster. Deducting these (Tacoma, 1900, 51 killed, and Stratford, 1899, 29 killed) we have an annual average for six years of 35½ killed; including the two, the average is 49. The list of causes of electric car accidents would include the usual variety, familiar to readers of our monthly reports. The feature of this record most noticeably different from that of standard railroad accidents is the frequent runaways. Cars dash across railroad crossings and tumble into rivers; but the passengers often succeed in escaping from the car just in season to avoid the crash.

Something New in Electric Traction.

For a number of years an American electrician advised the Manhattan Elevated of New York to postpone the adoption of electric traction, because of the still undeveloped state of the art. As he is considerably interested in making and selling electrical apparatus his advice must have had much weight. An apparent confirmation of his wisdom comes now in the proposition made by Ganz & Co., of Budapest, for electrifying the old underground railroads of London now worked by steam. A description of some of the essential features of their system appears on another page. Briefly, they propose to use an alternating three-phase current, transmitted at 20,000 volts, more or less, and reduced to 3,000 volts at the motors. This would permit a saving in first cost and some saving in some parts of the working expenses. Indeed, the savings promised are so great that the plan seems almost revolutionary.

There is, however, another side to the question, and the gentleman who describes the Ganz system does not tell the whole story. The idea is not new, but has been attractive to investigators for some years; but they have generally run against a low efficiency, and hence high fuel cost, and also unsolved mechanical difficulties. If we take, for instance, the Manhattan Elevated in New York we may reasonably conclude that the company is justified in going ahead on the lines now laid out instead of stopping to await the development of the Ganz system. Let us guess that by the use of such a system as is described as being experimentally worked at Budapest and being installed at Lake Como in Italy the Manhattan might save perhaps $3,000,000 in first cost, in that the convertor stations would be reduced to simple transformers, cutting down the cost of machinery and of real estate and doing away also with a considerable item of wages. On the other hand, we may guess that because of low efficiency the alternating current system would add perhaps 30 per cent. to the fuel bill; that is to say, something like $120,000, which is 4 per cent. on $3,000,000, and thus the saving in first cost is wiped out. But, the central station plant would be more costly in some elements because of the lower efficiency of the alternating current system. Whether or not the saving in wages would be more or less than the additional cost of feeders and other details with the high potential, three-phase current we cannot pretend to judge.

Still further, the Manhattan, and for that matter the Metropolitan in London, can hardly afford to make experiments with novel and undeveloped methods and machinery. It is their business to put in a system which is certain to work reliably and smoothly and the weaknesses of which are well understood. The Manhattan is carrying a traffic which is steadily working up again to its old maximum of 200,000,000 or more passengers a year, and it cannot afford to make experiments with the movement of such a traffic.

On the whole, then, while the Budapest system is exceedingly interesting and suggests great possibilities, we should not suppose that the Metropolitan of London would be justified yet in installing it; but it might be justified in suspending its schemes for electrifying until the Lake Como line has been working a year. But further we should not suppose that the Manhattan would be justified in even stopping to consider any change from the system now under way, which can shortly be put into service and begin to produce increased net revenue.

Annual Reports.

The Southern Pacific Company.—The 16th annual report of the Southern Pacific Company, being for the year to June 30, 1900, was issued late last week, and is perhaps the last that will be issued, a fact which one can hardly realize. In the year the company operated an average of 7,545 miles, an increase of 370 miles over the preceding year. The gross receipts from transportation amounted to upwards of $63,920,000. The total receipts, including trackage, income from investments, interest, etc., amounted to $65,980,000. Receipts of the Southern Pacific Company from sources other than from the operation of leased lines were $2,147,710; thus the total receipts were $68,128,000. The operating expenses were $41,409,000, and the total disbursements, including interest, taxes, trackage, etc., amounted to $58,197,638. There were further expenditures for interest on the funded debt of the Southern Pacific Company, etc., of upwards of $2,000,000, making total disbursements of $60,875,000, and leaving a balance of $7,753,421.

Upwards of $3,000,000 of this balance was spent for betterments, additions and new equipment for the proprietary lines and one-quarter of a million was paid in dividends on the preferred stock of the Central Pacific. The surplus over all disbursements amounted to $3,919,000. The greatest single item in the expenditures from income for betterments and equipment was something over $1,000,000 for new equipment and machinery. Half a million was spent for various fixed structures other than bridges and almost half a million for improvements of bridges, culverts and trestles. About a quarter of a million was spent for ballasting and $429,000 for 129 miles of new sidings.

The details of the betterments are given at length in one of the tables, and another table shows in detail the material used on bridges and track, and track condition at the end of the year. There we find that over a million burnettized cross ties were put in during the year, and over a million of ties which were not treated, while the tie plates used during the year amounted to about 4,250,000. The total number of tie plates in the track now is 16,911,000. The burnettized cross ties are 5,315,000 and the creosoted cross ties 68,000. The total number of cross ties in track is 26,819,000. There is 147,000 lin. ft. of trestle built entirely of creosoted lumber and 51,000 lin. ft. of trestle with creosoted piles and caps.

The locomotives received during the year numbered 53, and the freight cars of various classes 4,500. The expenditure for new equipment was $4,008,000, of which over $1,000,000 was charged to income account. This includes $314,000 on marine equipment and shop machinery. The charges to capital account for new equipment amounted to a little more than $600,000 and $1,862,000 was charged to the Improvement Fund. The new locomotives averaged 70 tons without the tender, and the capacity of the new freight cars averaged 35 tons. At the end of the fiscal year 88.45 per cent. of the freight cars were equipped with air-brakes and 97 per cent. with automatic couplers.

The gross transportation receipts increased during the year 12.96 per cent., and working expenses 13.55 per cent. The passenger-miles increased 21.9 per cent., and aggregated 817⅓ millions. The average passenger rate was 1.94 cent. The ton-miles of all freight increased 18.49 per cent., and reached the immense amount of 4,688¾ millions. The average ton-mile rate on commercial freight was 0.957 cent. The earnings per freight train mile amounted to $2.51, and the average load per train mile was 295.3 tons. This was an increase of 32 tons, or more than 12 per cent. over the preceding year. The traffic train load was 241.85 tons. The distinction made in this report between a train mile and a traffic mile is that the train mile covers the mileage run by trains with a full train crew, while the traffic mile includes the mileage of helping engines and engines running light over the road.

We have spoken above of the charges to capital account for new equipment. The total charges to capital account for improvements to the physical property amounted to $10,935,000. This included extensions, additions and betterments of road and of all classes of rolling stock and equipment.

NEW PUBLICATIONS.

The Cement Industry; Descriptions of Portland and Natural Cement Plants in the United States and Europe, With Notes on Materials and Processes in Portland Cement Manufacture. Octavo, 236 pages; illustrations. New York: The Engineering Record. 1900. Price, $3.

Some years ago the *Engineering Record* began the publication of a series of articles on the European Portland cement industry, which series speedily developed into descriptions of numerous cement plants in this country as well and these articles have been collected in the volume now issued. The first chapter is general, being a sketch of materials and processes. The last three chapters describe plants in England, Belgium, Germany and France, and another chapter describes the American rotary kiln process. Eighteen chapters are given up to the description of as many individual plants in the United States. These descriptions are detailed and well illustrated and the volume will suffice to inform the reader quite completely and accurately as to the present status of this important industry. Much the greater part of the descriptions has been written by Mr. Frederick H. Lewis, although Mr. Henry C. Meyer, Jr., and other writers have contributed chapters. The general chapter is by Mr. S. B. Newberry.

Questions and Answers from the American Machinist. Compiled by Frank Richards. 404 pages; 12 mo. New York: American Machinist Press. 1900. Price, $1.50.

The last question in this volume is 1088, and is: "Q.—Has the inventor owning a part interest any rights which an assignee owning an equal interest does not have? A.—No." The first question asks what is meant by absolute, initial and terminal pressures, and the answer is not quite so short. Between these two questions there is a range so great that it is quite impossible to make any accurate analysis or description of the topics covered. The book is, however, roughly divided into 21 departments, covering boilers, engines, pumps, power transmission, shop practice, blacksmithing, etc. The preface informs us that more than 10,000 questions have been answered in the columns of the *American Machinist*, and of these about 10 per cent. have been collected and reprinted in the volume, with the belief that they have a certain permanent value.

Perhaps taking two or three questions at random as we open the volume will be the best way to give a notion of the topics treated. "Considering only the question of heating a shop, is it preferable to use steam about 75 lbs. pressure or at a lower pressure? What degree of compression is usual in gas engine practice? What is the simplest rule for calculating the power transmitted by belts, either single or double? How can I temper chicken gaffs? I want a good spring temper and they must not break." In answering this last question the editor pretends that he did not know what was meant by a chicken gaff until he looked it up in the Century Dictionary, but we conjecture that such ignorance is only affected. At any rate, we can imagine that a good many boys and men will get information as well as entertainment from this volume.

An American Engineer in China. By Wm. Barclay Parsons. Cloth, 12 mo., 322 pages. Illustrations, map and index. New York: McClure, Phillips & Co. 1900. Price, $1.50.

In 1898 Mr. Parsons went to China as Chief Engineer for the group known as the "Brice Syndicate," who hold a very valuable concession covering a railroad from Hankow to Canton, about 900 miles, as well as mining and other privileges. His reconnaissance of this railroad route took him from the Yang-tze Kiang up the valley of the Siang-Kiang, over the Nan-Ling divide, and thence down the southern watershed to Canton. In this journey it was his privilege and duty to cross the "closed province" of Hu-nan, one of the richest and most populous parts of China and the most anti-foreign. Lord Charles Beresford, in his recent valuable book, "The Break-up of China," said, "Foreigners who penetrate into Hu-nan, even by the help of the mandarins, do so at the risk of their lives." Mr. Parsons tells us that Pumpelly, Baron Richtofen and Morrison, an English engineer, had crossed Hu-nan (Pumpelly got less than half-way across) but were compelled to keep to their boats, and could therefore see but little of the country. These gentlemen have given us the only accurate knowledge of the region that we possessed before Mr. Parsons' successful journey. From information not gathered from Mr. Parsons' narrative we know that the mandarins and Americans and Europeans resident at Shanghai were very doubtful of the possibility of carrying a survey through the country and, indeed, of crossing it at all; but obviously an engineer who had gone to China for the purpose of making the survey was bound to try at any risk, and fortunately he succeeded without the loss of a life, and with but little inconvenience. In the country crossed for 500 miles he was the

first foreigner ever seen, and he ran the longest instrumental line that had ever been measured in China, at least the longest that we know of. It is impossible to say what the Chinese themselves have done in connection with their canal work in the centuries past; but it is safe to say that what surveys they may have made are unavailable and would be useless if they were available. Mr. Parsons' duties took him to various cities from Canton to Pekin and brought him into close contact with people and officials from the peasants of Hu-nan to the mandarins of the Tsung-li-Yamen, and he made good use of his opportunities and of his trained faculty for observation. Furthermore he saw the country in the critical moment, just when an industrial and social and political change (perhaps amounting to a revolution) is taking place.

The small volume before us records many facts gathered in this interesting journey of an engineer, but we cannot stop now to speak particularly of the chapters dealing with the history, commerce and finance of the country or with the characteristics of the land and its people. The chapters of most especial interest to our readers are those which treat of engineering and architectural construction, inland communication in general and railroads in particular.

It is an acute observation that Chinese engineering has proceeded quite successfully along static lines but has rested for centuries without progress in all that involves motion. Thus, while their fixed structures are respectable and frequently beautiful their machines for doing work and moving people and goods are rudely primitive.

The true arch is found "of most widespread and general application . . . composed of a complete ring of voussoirs, radially jointed and of proper proportions." Several beautiful examples are shown by photographs, and there are so many of undoubted antiquity that it is probable that the Chinese built arches long before the Romans. It is interesting to learn also that our very modern "cage construction" has been practiced by the Chinese for centuries and is found all over China. The frames are of wood and to these are applied thin walls of brick. Had the Chinese developed skill in rolling iron Pekin might now have its ancient steel frame buildings. But the great field for engineers in China is in transportation and machinery.

Land transportation is now by wheelbarrows, or by packing on ponies and men, while the inland, water-borne traffic goes by sailboats equipped and handled with inconceivable shiftlessness. Here again, however, we come upon one of the numerous instances in which the Chinese have anticipated by centuries our modern inventions. The hull of the ordinary river boat is divided by transverse wooden bulkheads. Marco Polo described these in the thirteenth century and said that they were used for security against leaks. Mr. Parsons concludes that it will probably be found inadvisable to try to improve the waterways on a great scale, and that it will be more practicable to build railroads parallel with the rivers. His short discussion of this topic is important.

Our readers have been kept so well informed about the railroads of China for the last eight or ten years that we need not say much now of Mr. Parsons' railroad chapter, the longest but one in the book, but it should be carefully read by those who wish to know the actual situation. He finds that the lines now built, including 125 miles of the Russian Manchurian line, sum up 814 miles; the lines under construction are 636 miles, and the concessions to foreigners amount to 5,680 miles. Of the line built considerable has been badly crippled if not actually destroyed by the Boxers and must be practically rebuilt. We cannot say how much this amounts to, for the statements have been conflicting. It is quite unnecessary to say a word as to the importance of China as a field for our enterprises; but it is interesting to find that Mr. Parsons is disposed to cut the estimated population of China in two and to put it at nearer 200,000,000 than 400,000,000, and in this we quite agree with him, so far as we venture any guess. But 200,000,000 people can produce and consume a good deal of material and can furnish traffic tonnage for several times 5,000 miles of railroad.

The Department of Tests on a Railroad.*

The purchasing department of a railroad is unquestionably the one which receives more assistance from, and gets to depend more on a department of inspection and tests than any of the others. Unless the purchasing agent bases his requests for prices, or inquiries, as they are called, on definite specifications or well understood standards, the prices he obtains are apt to be most misleading. In the first place the bidder has often no idea of the desired quality or the special character of the material on which he is asked to name a price, and knowing the general practice in competitive buying to be to award the order to the lowest bidder, he naturally offers the cheapest grade he handles in order to secure the business, generally without any intention of deceiving, but simply from lack of adequate and sufficient information. Manufacturers or dealers who make or handle only the better grades of supplies have, therefore, under that system, not the slightest chance of introducing their goods.

There is no question as to the advantage of every road having specifications for the more important classes of supplies. But it is equally certain that it is useless to specify in detail the character and quality of the material to be purchased, without some system of inspection and tests by which the buyer may be sure he is getting what he asks for. It may be argued that orders should be placed only with such firms as have their own system of inspection and tests, and may be relied upon to ship goods strictly as ordered; but even if it were safe to act on this principle, it would be an expensive practice, for it would do away with competition.

It is well to take for a foundation specifications which have been in use on other roads and have stood the test of time, making only such changes as the special conditions existing on the roads for which the specifications are being framed seem to require. It is also of advantage to submit specifications, when first drawn up, to some of the leading manufacturers for their criticisms, before their final adoption, for these men should be able to speak as experts. It is undesirable to dictate to the manufacturer in detail the processes by which he must make the material ordered; that is his affair, and should be left to him, the railroad only concerning itself with the results.

It is desirable for small roads to maintain a chemical laboratory, and have material the quality of which can be better determined by physical tests, examined at the mill or foundry before shipment, either by an inspector in the regular employ of the railroad company, or by some independent inspector or bureau of inspection. There are advantages in having the chemical work done in the road's own laboratory, very satisfactory results being obtained even if only one chemist is employed. In the first place if every analysis made is to be paid for there is a temptation to reduce the number of such analyses to an extent which destroys the efficacy of the system of buying under specifications, and a great deal of important work in the line of investigations outsides of the routine test of supplies is neglected, or if all the work which would be done in the company's own laboratory is given to commercial chemists, the cost would be greater. It would seem natural to expect more zeal from a chemist working solely in the interest of the railroad company, than from the chemists in a commercial laboratory who may be also employed by the manufacturer or dealer who furnishes the material, as well as by the railroad which purchases it. If these chemists reject material on behalf of the consumer, they are liable to arouse the resentment of the seller, and perhaps get no further business from him, and this fact may somewhat influence their decisions in cases where there is room for any possible doubt. Of course there are commercial chemists who are absolutely uninfluenced by such considerations, but there are others, I believe, who, while wishing to be honest and impartial, might almost unconsciously yield to this temptation to favor the manufacturer.

That it is practicable and desirable for a small railroad to maintain its own laboratory and a system of inspection and tests of supplies purchased, I think I may assert positively after my four years' experience on the Long Island Railroad as Purchasing Agent. During nearly the whole of this time a laboratory has been in successful operation under the charge of a very competent chemist reporting to me, who has done all of the chemical work which I have considered necessary, and who has also inspected material and conducted mechanical tests at mills and foundries in or near New York and Philadelphia, all bridge work and rails, and inspection at Pittsburgh and some other points being handled for us by local inspectors.

The supplies which are inspected and tested for us at the point of manufacture by our own or by an outside inspector are:

Steel bridges, boiler and fire-box steel, tank steel, boiler tubes, car and driving axles, car wheels, steel tires, crank pins, car and engine brasses, steel rails, splice bars, track spikes.

Bar iron and steel, stay bolt iron and bolts, rubber hose, waste, and now and then cements, are inspected after their arrival, and occasional tensile tests are made at Long Island City by our chemist and inspector on a testing machine, owned by another corporation, but which we are privileged to use. It would be a useless expense for a small road to buy a tensile testing machine, as it is customary to have such tests made on the machines at the mills.

In our chemical laboratory the following supplies, bought under specifications, are analyzed:

Fire-box steel, axles, splice bars, oils, paints, brasses, alloys (bearing metal, solder, etc.), ingot metals.

With only one man in the laboratory, it would be obviously impossible to analyze every barrel of paint or test every shipment of oil, but the manufacturer knows that we are liable to make tests at any time, and frequently do so.

Certain classes of material, however, are never accepted by us without being subjected to the most rigorous inspection and tests, viz., fire-box steel, cast iron wheels, car and engine brasses and air-brake hose. There is perhaps no class of material which shows the benefit of careful inspection in a more striking manner than car journal bearings, for to no one cause can hot-boxes be traced more frequently than to ill-fitting or improperly made and finished brasses. When the laboratory was first established on the Long Island Railroad, hot-boxes, with the attendant annoyance and expense, were a frequent occurrence. Now they are comparatively rare. Every single bearing made for us is examined before it is lined to see if the radius is right and the bearing surface smooth, some are broken to see if the metals are well mixed and free from oxidation, dross and other impurities, and bearings are taken from the broken samples and analyzed in our laboratory to determine whether they have the specified composition. In addition to obtaining practical immunity from hot-boxes, this enables the purchasing agent to make sure he is getting the market value of the alloy specified; for with tin worth 27c, copper 17c, lead 4½c and zinc 4c a pound, it makes a great difference in the value of the new bearings as well as when they are sold as scrap, in what proportions these various metals are present, and there is absolutely no way of determining this except by chemical analysis. For this reason it is purely guess work to buy or contract for brasses except on the basis of specifications supported by tests.

When I began to buy solder, I specified that it should be "strictly half and half," (the trade designation for solder consisting of 50 per cent. tin and 50 per cent. lead), and although being struck with the variation in prices obtained from different dealers, I did not at first consider the matter of sufficient importance to get samples and have them analyzed, but bought of the lowest bidder. Finally complaints reached me from the shops, and on analyzing the lot complained of, our chemist found a little over 40 per cent. of tin instead of 50 per cent. with 60 per cent. of lead, and on getting samples from five or six dealers, we found only two samples which were of the composition specified, and they were the highest priced article, but on making a calculation on the basis of the market prices, we found them fully worth the difference in price. Paint is another striking instance of this kind. Every purchasing agent knows how perplexing it is to decide between different claimants for his orders for paints, those failing to get the orders on account of their higher prices claiming, and often with truth, that their products are superior; but with no means at his command to verify that statement, the purchasing agent is forced to follow the only guide he has, and buy the cheapest in price, but which may well prove to be the dearest in the long run.

But the value of a laboratory is by no means confined to the services it renders in protecting the railroad from poor material, for the chemist is constantly called upon to analyze samples of various kinds submitted by concerns who have never had any dealings with the railroad, and are anxious to make a beginning, and an unfavorable report from the laboratory gives the purchasing agent an opportunity to rid himself of the importunity of persistent salesmen in such cases, while a favorable report enables him frequently to buy with advantage to the road. Moreover, it is a convenience to the Superintendent of Motive Power to have some one man to arrange for and conduct tests in actual service, to which he would otherwise be forced to give his own personal attention. Among these may be mentioned tests of coal on locomotives, smoke consumers, patent lubricators, waste for packing car journal boxes and substitutes for waste, new designs for car journal bearings, car cleaning compounds, metal polishes, boiler scale preventives, disinfectants and plush renovators. Another important line of work for the laboratory is the investigation of the water supply of the road.

The testing department on a few roads is directly under the General Manager. This arrangement I consider the proper one, as the department is then a check on the Purchasing Agent and Superintendent of Motive Power, and prevents the one official from buying and the other from using material which is not up to the standard, but which from motives of personal interest these officials might be disposed to accept. However, I firmly believe, judging from the railroad officials whom I have known, that such a check is not usually necessary, and that the great majority of purchasing agents and superintendents of motive power have a high sense of honor, and are devoted to the best interests of the company by which they are employed, but I regret to say that I have known of two or three exceptions to this rule. It is well in any case I think to have the decisions of the head of the test department absolutely uninfluenced by the possible sympathies or prejudices of these officials, and make the specifications themselves the final arbiter, which can best be accomplished by giving the testing department an independent position in the organization. Of course the head of the department should be selected with great care, the man's character and reputation for honesty being as important as his scientific attainments, experience and judgment. In a measure his assistants are in turn a check on him.

Another argument in favor of the testing department serving as an independent bureau of information is the fact that other officials besides the purchasing agent and superintendent of motive power, particularly the chief engineer, have an interest in its work and may wish to refer matters to it for investigation.

On a small road where perhaps two men, one an engineer of tests and inspector, the other a chemist, constitute the whole force, the simplest and best way would be to have these men report to the superintendent of motive power, if he is in sympathy with the idea, otherwise not, as the greater part of the work liable to be undertaken would be for the immediate benefit of the motive power department.

It is quite possible to accomplish good results with only one man, instead of two, if that man has had a mechanical as well as chemical training and experience, but such men are, of course, rare. In any case it would be unwise for a small road about to establish a laboratory and inaugurate a system of inspection and tests of its supplies to take men fresh from a college or technical school, for practical experience in the special requirements of railroad service is of the utmost importance.

*Extracts from a paper by Mr. H. B. Hodges, Purchasing Agent and Superintendent of Tests, Long Island Railroad, read before the New England Railroad Club at the January meeting.

and the wisest course to pursue would be to select a man from the assistants in some one of the large railroad testing departments in the country. For the small sum of $1,000 a railroad can fit up and stock a chemical laboratory, the value of which I hope I have demonstrated, and I think if railroad officials would carefully consider the matter in all its bearings, the question will not be "can we afford to establish and maintain a testing department?" but rather "can we afford to do without one?"

Professor G. Lanza.—A testing machine can easily be bought for six or seven hundred dollars, and I think of a great many things in which it would save a railroad expense and trouble far more than enough to pay the interest on $600. Then, among the many questions that arise on railroads generally, there are all sorts of devices, all sorts of methods of procedure, that require either partial or full road testing, in order to determine which is the most economical, as well as to give indications regarding the best kinds of locomotives to buy or build for any special service. On some roads there seems to be a fear that anything in the way of road tests is going to cost a great deal of money, and cause a great deal of trouble, but a number of roads are doing such things, and as soon as their importance is realized, so that such tests are attempted, the cost will be found to be not very much.

Of course, there is one thing all important in regard to any tests, and that is, unless they are correctly performed, they are useless, because the information that is not correct is worthless. There is another thing which Mr. Hodges did not mention which is of the greatest importance for the railroads, viz., the testing of lubricating oils.

Mr. Hodges.—A chemical laboratory requires a smaller outlay than a physical laboratory, and for a road that does not care to go to heavy expense for a testing department, I think that would be the place to begin. I feel just as strongly as Professor Lanza does about the value of physical tests. As I mentioned in my paper these are made by us, but they are made on machines generally owned by mills at the present time, and by the use of these testing machines every railroad can accomplish the object desired, and make all necessary physical tests conveniently and cheaply, so that the necessity for a testing machine on a railroad is not so great as it otherwise would be. Of course, there are times when it is desirable to discover the cause of the failure of material in service, or to carry out any other special line of investigation, when the testing machine would be of great value, but in Boston it may be possible to get the work done, I suppose, in the Institute of Technology, where the work would be done most skilfully and more economically on the whole than by establishing a physical laboratory on a road for this purpose. On the Southern Railway we had a 200,000-lb. Ohlsen testing machine, but we rarely used this machine, because our material was tested at the mills.

Prof. Lanza mentioned oil as one subject on which more stress should have been laid. In my paper I spoke of oil as being one of the best things to be tested, but I did not dwell particularly on it, although it is a very important matter. At the same time, I think this is a fact, that the quality of oils on the market to-day is much better than it was 15 years ago. There is no question about it in my mind. There is no longer that absolute necessity for guarding against inferior oil that there was 15 years ago, when I had to reject cylinder oil on the Union Pacific Railroad, with 7 or 8 per cent. of free fatty acid.

The same thing is true of headlight oil, for we have failed to find on the Long Island Railroad a single case where the flash-point of headlight oil was below the point specified, although formerly on the Union Pacific, and even on the Baltimore & Ohio, I have rejected this class of oil on account of flash-point, but the fact that the quality of oil seems to be improving should not by any means lead us to cease all vigilance, although I did not dwell on the subject of oil for the reasons which I have stated.

Mr. J. H. Graham.—Mr. Hodges could properly add another field to his investigation. I would call it a "Bureau of Design," which should have charge of all patterns, etc., over the entire system, and of all departments, for the locomotive and car departments are not the only sinners in this matter. Before a pattern went to the foundry, an expert should examine it to see if it was properly designed, and if the metal was strong where the stress came, and all surplus material cut away where not required. The pattern should be weighed, and the foundryman told what the casting should average. When it was received, it should be weighed, and all over-weight deducted from the bill. This is a healthful plan for the railroads, as they are now carrying around thousands of tons of surplus material, due to faulty design.

Professor Allen.—Mr. Chairman, there is one point that seems to have even greater importance than Mr. Hodges gave it, and that is the question of the purity of water. There is no doubt that there is a very great saving in the cost of fuel used when water is purified, so that you do not have to force the fires against scale in the boilers; and people naturally figure up the economy of coal, and are properly convinced that it pays very well to do something in order to save the fuel. There is, however, another economy in that connection which is perhaps greater than that which appears directly in the saving of fuel. It is understood nowadays that the tonnage rating of a locomotive depends not altogether on the adhesion of the locomotive, but does, in critical places, depend rather on the horse-power of the locomotive, that is, on its ability to make steam, and when your boiler is covered with scale, you fail to get the proper steaming capacity from your locomotive, and therefore do not get the tonnage capacity behind your locomotive that you ought to have. Probably the greatest economy that is secured in using good water, and the greatest economy in a great many other items in railroad operation, is found not in the saving of coal so much as it is in the longer train that can be hauled behind the locomotive. Therefore, if you can increase your horse-power, if you can increase the steaming capacity of your locomotive, so that you can haul two or three cars more in the train, you have secured an economy that is far greater than that which is measured simply by the coal consumption.

Mr. Dean.—I should like to ask Mr. Hodges what they do on the Long Island Railroad with reference to determining the proper quality of coal, or, in other words, what tests of coal are used, if any?

Mr. Hodges.—I think it would be impossible to properly determine the value of coal simply relying on a small testing department, consisting of two or three men. That requires a more thorough system of tests than we have been able to undertake. We have found one thing though which is rather striking on the Long Island Railroad, that the analysis of the coal will give us an approximate idea as to whether or not it will probably haul our trains on schedule time. We find semi-bituminous coal will not do that, and we require a coal which shows from 33 to 34 per cent. volatile combustible by proximate analysis. Moreover, the coal is put in service and tried, and in a general way an idea is obtained as to its steaming qualities, and the amount of smoke and ash it produces. Of course, this is all very crude. We do not pretend to have conducted proper coal tests, but these give us some relative idea, at all events, of the value of the various coals which we have examined.

Massachusetts Commissioners on "Vestibules" for Motormen.

Acting under a law passed at the session of 1900, the State Railroad Commissioners of Massachusetts have issued a decision holding that the street railroad companies in Boston must provide an enclosure at the front of each car for the protection of the motorman in cold weather. The substance of the decision follows:

The Legislature has declared that street cars shall have their platforms inclosed for the protection of employees, during the months of January, February, March and December in such manner as this board shall approve. But in Boston the Commission may suspend the law on application.

The single question before the board is that of relative safety of operation of street cars. Absolute safety is unattainable in the operation of any car. The management of the Boston Elevated Railway (operating the surface street lines and claiming exemption) is admittedly able and efficient, and yet accidents are not infrequent. Aside from those which may be due to any lack of precaution on the part of employees there are many that arise from the fact that the company is unable to take care of those who will not take care of themselves. The question is whether the use of cars with enclosed platforms will increase this liability to accident.

Much evidence, for the most part expert opinion, has been presented to the board, and the inquiry has extended to nearly, if not quite all, the larger communities in the United States and Canada.

It would seem to be admitted upon all sides that vestibuled cars can be safely operated upon country roads and upon the streets of the smaller towns and cities. As to the safety of operation of such cars upon the crowded streets of a populous city opinions differ. In several instances the views of independent managements in the same city, each of which has had experience with vestibuled cars, are at variance—the one declaring such cars safe and the other declaring them unsafe. Two public boards, after investigation, have decided that the use of vestibuled cars in large cities is dangerous. Public authorities in other instances have indorsed their use.

It is a significant fact that the number of these cars in actual operation has increased steadily, and that nothing seems to have occurred to lead companies that have once introduced them to do away with their use. The closer the acquaintance with actual results the more the vestibule has grown in favor. Opinions to the effect that they increase the liability to accident are seldom supported by any conclusive proof of the correctness of the belief from the record of accidents.

The petitioners urge that apprehension of peril in the use of enclosed platforms is justified from what is claimed to be their interference with a proper exercise of the senses of sight and hearing on the part of motormen. As to the ordinary streets within, and the wider streets and avenues without the business centers of the city, we cannot agree that such apprehension has any reasonable foundation. We think experience has demonstrated that in such streets these cars can be safely operated. The weight of the evidence before us allows no other conclusion.

In some of the very narrow and crowded streets of the city, however, for example at the corner of Washington, Summer and Winter streets, where men and women and carriages and cars are frequently making common use of the way, and avoiding one another as best they can, there is more reason for fear as to the effect of enclosed platforms. An unobstructed view as well upon all sides as in front is of great importance to the motorman. The cars are necessarily moving slowly, and to meet an emergency at any minute likely to arise the motorman must not only have the power to stop the car at once, but he must have every opportunity for receiving instant notice of the need. In some other places peculiar conditions may be similarly exacting.

Were it impracticable to provide a vestibule which would allow the motorman the fullest command of his faculties and senses in such situations, we should be obliged to decide that vestibuled cars could not be safely operated in these localities. We are not satisfied, however, that vestibules cannot be provided of such a character as not to materially obstruct the view. They surely can be constructed with windows that can be easily lowered and with doors that can be readily opened.

Should there be any reason to fear that the enclosed platform would, upon certain streets, be objectionable, the windows could be lowered and the doors opened and the car thus practically operated as an ordinary car. A rule requiring cars to be operated in this way upon approaching places where peculiar conditions seem to require it would be easy of execution, and would add nothing to the responsibility of employees in calling for the exercise of discretion.

The same rule could well be applied to the operation of cars through the subway.

To avoid delay from the use of one platform only for entering and leaving the cars at busy stations the front platforms could be freely used at such stations by opening the doors.

It has been urged that the necessity of shutting the front platforms from view after dark in order to prevent the light inside the car from disturbing the view outside, is a source of danger from the possibility that the motorman may be suddenly disabled. Experiments show that this danger can be avoided by leaving uncurtained a space which will disclose the motorman at his post without allowing the escape of light from the inside in such a way as to confuse the view.

Upon the whole, we are not prepared to say that in our opinion cars with platforms properly enclosed and controlled, as we think they may be, cannot be safely operated in the city of Boston. We must, therefore, find adversely to the claim of the petitioners. . . . We fix Jan. 1, 1905, as the time within which the petitioners shall enclose the platforms of cars in the manner provided by law.

For a test, cars with platforms enclosed in a manner approved by the board, shall be provided on certain lines by Dec. 1, 1901. If, as a result of actual experience, the opinion that these cars can be operated safely within the city of Boston shall prove to be incorrect, the decision now rendered will be revoked.

An Old-Time English Railroad.

BY W. B. PALEY.

Few places in England are better known to Americans than Stratford-on-Avon; yet few of them find out that it contains a singularly perfect specimen of an early horse railway or tram road. Guide books don't mention it, taking for granted people are interested in Shakespeare alone, and it was made, used and disused before most of the present inhabitants were born.

The line in question starts from the canal basin at Bridgetown, adjoining the bridge over the Avon. It has a brick 8-arch bridge of its own close to the other. A weighing machine by the road side is its exact starting point, and it formerly had sidings round the canal wharves. After crossing the river the railroad, which is only a single line, proceeds at a moderate rise up an embankment, the slopes of which are now well grown over with trees. It crosses over the East & West Junction Railway, then goes over a branch road on the level, and keeps closely alongside the turnpike road for many miles. The old rails and sleepers are there, quite untouched. The former are wrought iron "fish bellies," 15-ft. lengths mostly, weighing, perhaps, 35 lbs. per yard. Very small chairs are used, of 7 or 8 lbs. each. The sleepers are a yard apart. Narrow iron keys, some 6 in. long and ¼ in. thick, are used here and there, but in many cases small split pins go through transversely instead to keep the rails tight in the chairs. Fish plates being unknown, the two rail ends simply meet in a chair. A half-hole or semi-circle is bored out of each end, to admit of a round iron plug being put through them and through the jaws of the chair, to keep the rails from springing. Wooden trenails and spikes hold down the chairs upon irregularly sized blocks of stone, one large being generally followed by two smaller ones. Naturally the level and gage are now a good deal out of truth, but the latter was originally laid as 4 ft. 9 in., and is still so in general.

A Mr. William James projected and laid out this line to run in connection with the canal and river navigations at Stratford for the supply of coal, lime, etc., to a large agricultural population. He was a man of considerable foresight, energy and ability, and undoubtedly helped forward the cause of railroads. He even believed in the locomotive at a time when any one who did was considered either a fool or a scoundrel who wanted to ruin the farmers by superseding horses. This line was the Stratford & Moreton. The Act of Parliament authorizing its construction with a branch to Shipston,

was passed on May 2, 1821, the main line, 16 miles long, being opened for traffic on Sept. 5, 1826. The branch, however, was not opened till Feb. 11, 1836. Carriers provided their own horses and rolling stock, with which they worked for hire. Passing places remain here and there, at some of which were formerly depots where coal, manure, etc., could be received. Locomotives were not used, chiefly owing to the line being made largely alongside a highway, but without larger blocks it could not have carried even the lightest engines satisfactorily. The rails and chairs, though of the same pattern as the original ones of the Liverpool & Manchester (1830), are less well supported than those were, yet the latter were found too weak even for 8-ton engines.

In 1852 the Stratford & Moreton passed into the possession of the Oxford, Worcester & Wolverhampton, now part of the Great Western. They connected it with their line at Moreton the following year, and until 1859 ran a horse coach on it for passengers, besides doing goods traffic, also by animal power. The coach made two trips each way daily in summer and one in winter. It was simply an old railroad carriage fitted with a box for the driver and seats on each side of him for outside passengers. They had to duck their heads, or take off their hats, at the only tunnel—a very short one. Down the inclines, which were taken at a good speed, the horse traveled on a little platform in front of the coach. Since August, 1859, when the first steam railroad entered Stratford from Honeybourne, the old tramroad has been entirely disused as to the 9½ miles or so between Stratford and the junction at Langdon road with the Shipston branch. The other part, from Moreton to Shipston, was rebuilt as a locomotive line by the Great Western a few years ago, and is worked at slow speeds with mixed trains.

Chelsea, London, S. W.

TECHNICAL.

Manufacturing and Business.

Bickford Drill & Tool Co., Cincinnati, Ohio, has just received an order for three large multiple spindle drills from the Baltimore & Ohio R. R. for its Mount Clare shops.

Sidney A. Stephens, for many years traveling representative of the Rhode Island Locomotive Works, has been appointed Agent for the Brooks Locomotive Works for the Dominion of Canada, with office at 22 St. John street, Montreal.

C. L. Sullivan has resigned as Superintendent of the Cloud Steel Truck Co., and has opened an office at 1515 Old Colony Building, Chicago. He will engage in the sale of railroad supplies and the "Handy" car which was described in our issue of Feb. 1.

Chicago rabbetted grain doors, made by the Chicago Grain Door Co., are specified on the following box cars, the orders for which were noted in the *Railroad Gazette* at the time the contracts were let: Cleveland, Cincinnati, Chicago & St. Louis, 2,200; Chicago, Rock Island & Pacific, 1,500; Northern Pacific, 3,000; Atchison, Topeka & Santa Fe, 2,000, and Rio Grande Western, 100.

E. R. Miner & Co., 29 Broadway, New York, have designed and built for the Citizens' Electric Light, Power & Railroad Co., Mansfield, Ohio, a number of combination gondola, flat and hopper bottom cars, the hoppers being so adjusted that ballast can be swung fast or slow. They have also just sold to the Dover Construction Co., Canal Dover, Ohio, 10 hopper dump cars, and have sent 10 logging cars to the Wilson Cypress Co., of Florida.

F. L. Dodgson, Chief Engineer of the Pneumatic Railway Signal Co., of Rochester, N. Y., sailed for England last week, where he will stay some time in consultation with the British Pneumatic Signal Co., proprietor of Mr. Dodgson's interlocking devices in the United Kingdom. Low-pressure pneumatic interlocking is to be at once put in at Basingstoke, on the London & Southwestern 48 miles from London. We learn (not, however, from Mr. Dodgson) that another English railroad has ordered a large interlocking plant from this company. The International company is to open an office in Paris, which will be in charge of Mr. W. J. Becker, who went to France last summer to exhibit this company's miniature pneumatic interlocking machine at the Paris Exposition.

Iron and Steel.

The American Bridge Co. is getting out about 20 bridges for the Erie R. R.

Last week the Ohio Works of the National Steel Co., at Youngstown, began a run of 130,000 tons of rails.

F. M. Jackson, General Manager of the Alabama Consolidated Coal & Iron Co., at Birmingham, has resigned, and the office has been abolished.

In 12 hours recently 524 tons of open-hearth billets were rolled at the new 40-in. mill of the new basic open-hearth plant at the Duquesne Steel Works.

The American Bridge Co. announces its sales during the month of January, 1901, as the largest of any month since the organization, aggregating over 60,000 tons.

A. E. Borie has been appointed General Sales Agent of Bethlehem Steel Co., with headquarters at South Bethlehem, Pa., the appointment dating from Feb. 1, 1901.

Track Tanks on the Lake Shore.

The Lake Shore is not doing anything at present in the way of increasing the number of its track tanks, but all road engines, both freight and passenger, as now built, are equipped with scoops. Of course, the plan is ultimately to avoid some freight train stops by using track tanks and scoops.

Springs.

Following is the text of a circular of inquiry from the Master Car Builders' Committee on revision of the present recommended practice for springs, including designs for springs for 100,000-lb. cars:

The Committee finds that the present recommended practice requires revision, especially in the springs for the heavier cars. The present dimensions given for springs C, D, E and F on M. C. B. Sheet J do not provide for sufficient material to enable springmakers to comply with specifications. It will, therefore, be necessary to redesign these springs in such a manner that they will contain the material required to meet the specifications as to height under given loads without overstraining the material, and without exceeding the limits in dimensions demanded by the construction of the modern freight trucks. To enable the Committee to make these modifications intelligently, as well as to recommend springs for 100,000-lb. cars, the assistance of the members of the Association in the line of furnishing data of construction of trucks, weight of cars, and style of springs now in use, etc., is solicited. The information desired as to construction of trucks is shown on the attached cuts [not reproduced here] which represent some of the more prominent makes, but which may also be used for giving the dimensions of any other makes of similar types. Please fill in the dimensions A, B and C for the different capacities of cars given in the tables. Dimensions B represent maximum height between truck box and top casting on pedestal trucks, and between spring seat and bolster on bolster trucks, with load of empty car. Other information desired is as follows:

1. Average empty weight of 60,000, 80,000 and 100,000-lb. cars, including trucks?
2. Detail specification of springs used, including weight of springs without spring caps.
3. The approximate number of such springs in service?
4. Have such springs been entirely satisfactory?
5. If not satisfactory, do they break, or take permanent set?

Please forward replies as early as possible, but not later than April 1, to Charles Lindstrom, Mechanical Engineer, Chicago & Alton Ry., Bloomington, Ill.

C. & N. W. Suburban Terminal.

The Chicago & Northwestern is preparing elaborate plans for a new suburban station at its Chicago terminals. This will be south of the present station and alongside the River, leaving the present station exclusively for through trains. The plans will also include new train sheds and storage yards and the proposed terminal improvements are estimated to cost over a million dollars.

A Street Car Explosion.

Last week some of the heating apparatus on a cable car in New York city exploded during the early morning hours when the car was crowded with passengers. Two or three persons were injured, but we have not heard that any were seriously injured. The car was lighted with Pintsch gas, and, of course, the story was at once started that a gas receiver had blown up. Inspection reveals the fact that the tanks under the car were not ruptured, and furthermore that none of the connections were broken. The tanks were still carrying 165 lbs. pressure of gas, and all the lighting apparatus was in working order. The lamps were somewhat burned and smoked, but could be lighted. None of the gas that had been supplied to the car the night before had leaked off. This seems conclusive.

THE SCRAP HEAP.

Traffic Notes.

The steamship "Para," from South American ports, arrived at San Francisco this week with 500 tons of freight which would have gone, in the usual course, to the Eastern States and Europe via the Panama Railroad, but, owing to the disagreement between that road and the Pacific Mail Steamship Company, it has been brought to San Francisco to be sent East over the Southern Pacific.

Chicago papers report that the railroads northwest of that city have agreed to discontinue giving passes to city officials and employees. According to the report this agreement will deprive of free rides a large number of policemen, firemen, city hall employees and post-office employees in Chicago and St. Paul. Half-rate tickets which have been granted to these classes under some circumstances, are also withdrawn.

There has been some demand, chiefly from the Southern Pacific, that passenger rates through the Washington gateway to the Pacific Coast from New England and Eastern points be changed so as to conform with those charged through Albany and other Northern gateways; but at a meeting of representatives of all the passenger associations held in New York this week it was decided that no change shall be made. The New England railroads objected, pointed out that there was already a short route to New Orleans via Albany and Cincinnati.

New York Freight and Transportation Bureau.

This is the name of a new organization just formed "to promote harmonious relations between shippers and carriers, and protect their interests." The Bureau has been incorporated. The office is at 127 Duane street, and the Commissioner is W. L. McCarty; W. W. Kughler is secretary, and the chairman of the Freight Rate Committee is Thomas M. McCarthy, of Austin, Nichols & Co., wholesale grocers.

Superposed Turrets for Battleships.

The Naval Board which consists of the Chiefs of Bureaus of Ordnance, Equipment, Construction and Steam Engineering, augmented by several other officers, last week decided in favor of adopting Rear Admiral O'Neill's plan of superposed turrets for all five of the battleships recently ordered, instead of for only three of them as at first planned. It is understood that the decision was not unanimous.

Intra-State Commerce Outside the State.

In the United States Circuit Court at Little Rock Feb. 5 Judge Triber rendered an opinion overruling the demurrer to the bill in the case of Kansas City Southern against the Arkansas Railroad Commissioners. The questions involved are the power of the State Railroad Commissioners to fix rates for the carriage of freight from one point in the state to another by a route passing for more than half the distance through another state or the Indian Territory. The Court held that such traffic is interstate and without the jurisdiction of the State Commission. The board is enjoined from enforcing its tariff as to such shipments, and is prohibited from suing the railroad company for penalties.

This decision is on a question similar to that decided by Chief Justice Fuller in 1892, the question at that time being one of taxation. The decision then was to the effect that "in the carriage of freight and passengers between two points in one state the mere passage over soil of another state does not render that business foreign, which is otherwise domestic." The Lehigh Valley was taxed by the State of Pennsylvania on its gross earnings, and on freight from Mauch Chunk to Philadelphia by way of Easton, Pa.; Philippsburgh, N. J., and Trenton, N. J., and thence over the Pennsylvania road to Philadelphia, the road claimed that no tax should be collected, as the traffic was interstate. The report of the case gives particulars of the way in which the business was conducted, from which it appears that the traffic in question was looked upon by the Court as though the Lehigh Valley ran its own engines through from Mauch Chunk to Philadelphia. The tax, however, was only for such part of the earnings as accrued on the line from Mauch Chunk to the New Jersey boundary (Phillipsburgh). At this distance it looks as though the Arkansas decision would be in conflict with that of the Supreme Court.

Combinations.

The air is filled with deals and combinations, and almost daily we hear of some railroad or industrial concern which has come under the management of the "mutuality of interests" combination. What the end of this extraordinary condition will be, and what will be the consequences is a problem in economics yet to be solved. The results up to this time have been apparently beneficial. A combination of a few but most powerful, capitalists controls nearly all of the principal railroad systems in the country, and the same combination appears to have acquired the leading coal properties and has now started in on the industrials by absorbing the greatest steel and iron plants of the country. It is almost alarming to consider the power wielded by this great combination. And yet it represents the highest and most scientific of all that goes to make up the financial, commercial and industrial systems of the country. The power thus concentrated, if exercised for good, must be generally beneficial, but if exercised upon selfish and monopolistic principles, would be an evil to be regretted and lamented. We do not anticipate any harmful results, for many reasons, one of which is sufficient—the influence of public opinion, which is more powerful than all the combinations in the world.—*Hambleton's Circular.*

Steel and Iron Rates on German Railroads.

The German Association of Iron & Steel Manufacturers has asked the Prussian Minister of Railroads to reduce the rates on bar and rod iron, wire, wire nails, fencing wire, nuts and bolts, axles, etc., to all the German, Dutch and Belgian ports. The Association claims that such a reduction is essential for the maintenance of the export trade in those articles.

Rules of Interchange.

Members of the Master Car Builders' Association having any suggestions to make as to the revision or modification of the Rules of Interchange, should communicate them to the office of the Secretary at as early a date as possible, in order that a proper compilation may be made for submission to the Arbitration Committee when it meets to prepare its report to the next convention on the revision of the Rules of Interchange.

Speed of Trains in France.

Last month, when M. Baudry was installed as President of the Society of Civil Engineers of France, he made an address in which he said something about recent improvements in train speed. From 1889 to 1900 there was an average gain in seven express trains on various roads of 20 per cent. in speed. The fastest train from Paris to Calais gained 58 minutes, or 23 per cent.; from Paris to Lille, 45 minutes, or 20 per cent.; from Paris to Nancey, 57 minutes, or 17 per cent.; from Paris to Marseilles, 2 hours and 50 minutes, or 20 per cent.; from Paris to Bordeaux, 1 hour and 52 minutes, or 22 per cent.; from Paris to Havre, 54 minutes, or 23 per cent.; from Paris to Rennes, 1 hour and 4 minutes, or 15 per cent.

The Grand Trunk at Portland.

The newspapers have recently said that the Grand Trunk Railway has made its Atlantic terminus at Portland instead of at Montreal; that is, that arrangements have been made for sailings from Portland which would practically take the Grand Trunk business away from Montreal. So far as we can ascertain, the matter amounts to this: Arrangements have been made with the Dominion Steamship Company for sailings from Portland similar to the arrangements made between the Dominion Steamship Company and the Grand Trunk for sailings from Montreal and similar to the arrangements between the steamship company and other companies for sailings from Boston. The Grand Trunk sailings from Montreal will be weekly to Liverpool, but it is not supposed that this will have any effect whatever as regards diverting business from Montreal.

Proposed Municipal Electric Railroad in St. Louis.

The Board of Public Improvements of the city of St. Louis, Mo., in connection with a projected electric lighting plant to serve the city's pumping plants in the north part of the city, is making plans for an electric railroad which, it is believed, will be the first municipal electric line in this country. The city already owns a single track road built to connect its pumping stations at Chain of Rocks on the bank of the Mississippi, and at Baden with the St. Louis, Keokuk & Northwestern line of the

Chicago, Burlington & Quincy, about four miles. It is used to supply the stations with coal, etc., and the cars are moved by engines from the Burlington. It is proposed to equip this track with the overhead trolley, and to use power from the electric lighting plant. At the beginning, in addition to supplies, only the city's employees will be moved; but later it is proposed to extend the service to the general public.

The Alton's 8-ft. Photograph.

The passenger department of the Chicago & Alton has issued a pamphlet showing exterior and interior views of the Alton Limited train. One engraving shows the entire train. It is reproduced from a photograph 8 ft. long by 4½ ft. wide. This is the largest photograph ever taken on a single plate, and a special camera had to be built for the purpose. Three of these large pictures were exhibited in different sections of the Paris Exposition, and in the pamphlet the building of the camera and the taking of the pictures are described at length. The Alton Limited is declared to be the handsomest train thus far built. All the cars are made with uniform dimensions and lines, and these symmetrical lines are even carried out in the locomotive and tender. The same colors and markings are used in painting the locomotive and tender as on the cars. The large photographs are to be put on sale by the railroad company at cost.

Mail-Pay Discussed in Congress.

In Congress last week Representative Moody, of Massachusetts, who was a member of the joint postal commission, spoke on the question of railroad mail pay in the light of the facts developed by the commission. He said that if the Government could have an ideal Second Assistant Postmaster General, who should serve for a long period, and who would be absolutely untrammeled in his negotiations with the railroads the Government would be able to arrive at a standard of payment which would be perfect as near as human imperfections would permit. He did not mean, he said, to reflect in any way upon the present Second Assistant Postmaster General. He was speaking simply of the difficulties which surrounded existing conditions. Mr. Moody said the postal commission developed the fact that instead of paying to the railroads an average of 40c per ton per mile for carrying the mails, as the Post Office Department had led the country to believe, the actual cost averaged about 12½c per ton per mile. It was difficult to tell which was the most profitable to the railroads, mail or express business. If he were compelled to guess he should say that the express business was more profitable than carrying the mails; that passenger business was less profitable than either, and that the most profitable of all to the railroads was carrying freight.

Mr. Bromwell, of Ohio, opposed the appropriation for the special facilities, declaring that the Postmaster General had repeatedly declared that he did not desire the appropriations and had only used them because Congress made them.

Mr. Catchings, of Mississippi, who was a member of the postal commission, denied the latter statement. He insisted that the Postmaster General desired Congress to take the responsibility of discontinuing the special service, because he did not want to assume that responsibility himself.

Mr. Myer, of Louisiana, defended the Southern fast mail appropriation. It was opposed by Mr. Gaines, of Tennessee.

Railroad Spotters.

Probably the most perfect spotter system thus far established by any private corporation is that of one of the big Eastern railroads. So far-reaching and so direct are its lines of communication that the President of the organization is kept constantly informed of the trend of affairs, and the changes of sentiment among the employees of every division of the whole system, and that without the knowledge of any other persons but his own clerks and secretaries. Nobody but himself knows the entire personnel of the wonderful service that he has perfected. His agents are drawn from every branch of the road's operating staff. They are engineers, freight brakemen, passenger trainmen, conductors, signalmen, yardmen, station agents, track walkers, and even division officials. Should that road have a strike the President will have warnings from all the storm centers long before the first mutterings find cautious utterance in the newspapers. While it also acts as a defense against thefts by employees, this system is intended primarily to prepare a diary of the disposition, character, workjng efficiency and sentiments toward the road of the men who constitute the vast human machinery of the corporation. If a certain division superintendent has made himself unpopular with his subordinates, information to that effect comes by "underground wire" to the central office. Every leading spirit in the employees' organization is known to the President, who also knows whether, in case of trouble, the man is to be reckoned upon as a conservative or a radical. Sometimes this works out the man's career in a manner quite incomprehensible to him. For instance, Night Watchman Brown is shifted, without cause that he can fathom, from one division to another to act as unconscious agent in checking a dangerous tendency. Where so many invisible lines radiate from the same office it is inevitable that some of them should cross. Curious complications result from contact between spotters as unknown to each other as they are to those whom they watch. Several years ago, at a time of general labor troubles, a certain railroad got no less than five reports from its confidential men informing them that an employee (who was several degrees higher in the secret service of the road than any of them, had they but known it) had been making incendiary speeches, which was true. That spotters should know each other as such is held to be highly undesirable. There is always the chance that they might work in conjunction, instead of acting as checks on each other.—*Ainslee's Magazine.*

Hot-Blast Heating.

In hot-blast heating, the proportional heating surface is generally increased in the number of net cubic feet in the building for each lineal foot of 1-in. steam pipe in the heater. On this basis, in factory practice, with all of the air taken from out-of-doors, there is generally allowed from 100 to 150 cu. ft. of space per foot of pipe, according as exhaust or live steam is used, the term "live steam" being taken in its ordinary sense as indicating steam of about 80 lbs. pressure. If practically all of the air is returned from the building, these figures will be raised to about 140 as the minimum, and possibly 200 cu. ft., as the maximum, per foot of pipe. Of course, the larger the building in cubic contents the less its wall and roof exposure per foot of cubic space, and consequently the less the loss of heat and the smaller the heater relatively to the cubic contents. In such buildings, used for manufacturing purposes, where the occupants are usually well scattered, an air change once in 15 to 20 minutes represents the general practice, but in public and similar buildings this change is of necessity reduced to one in 7 to 12 minutes.

Mechanical Draft.

A unique mechanical draft arrangement consisting of two fans was recently installed at the works of the Diamond Rubber Co., Akron, Ohio, by the B. F. Sturtevant Co. of Boston, Mass. Of its operation the owners write that "with the forced draft at one end and the induced draft at the other, we are enabled to produce a terrific draft, and can make steam very rapidly. We have been able to produce a pressure of 1.7 oz. by the forced draft fan and maintain a 2-in. water column at the extremity of our underground breeching or at the inlet of the fan."

Concession for a Railroad in Spain.

The Government of Spain has granted a concession for a steam railroad or tramway from Malaga, terminus of the Malaga & Cordova, on the Mediterranean Sea, to run southwest 78 miles along the coast via Coin, Mijas and Marbella to Esteporra, with a further extension permitted southwest about 20 miles to Gibraltar and La Linea. J. Enoch Thompson, the Spanish Consul at Toronto, Canada, owns the concession.

Technical Schools.

Cornell University.—Friday afternoon of last week Mr. H. G. Prout, editor of the *Railroad Gazette*, delivered a lecture before the engineering students of Cornell University on "The Future of the Engineer on the Railroads of the United States."

The Baltic-White Sea Canal.

Consul Winter transmits the following from Annaberg, Dec. 27, 1900: "Hand in hand with the great railroad enterprises nearing completion in the Russian Empire, the digging of gigantic canals is projected. In order to more rapidly develop the vast territory of Archangel, a water way of sufficient depth to admit vessels of ocean tonnage is being planned to connect the Baltic with the White Sea. The advantages of such a canal are manifold. The products of the fisheries of the Arctic Ocean may then be sent with ease to the markets of northern Europe, and the freight rates from the great grain-producing districts of the head waters of the Volga will be greatly reduced. The canal will also be of great advantage to the Russian navy in time of war. The maintenance of such a water way after completion, however, will be attended with many difficulties. For many months, it will be practically ice blocked, while the dense fogs which prevail in those regions during the fall of each year will render navigation very tedious."

The following additional details in regard to the canal are taken from *La Gazette Maritime*, Brussels, Jan. 17, 1901: "The total length of the canal will be 598 miles, 304 of which will be formed by lakes. The canal will follow the bed of the Neva as far as St. Petersburg, cross Lake Ladoga, and follow the Svir, which unites lakes Ladoga and Onega. Different water courses will then be utilized, the channels being enlarged and deepened, until the White Sea is reached at Soroskaya. It is estimated that the work will be completed in a year and will cost $10,300,000. Preliminary work has already been commenced."

Missouri Pacific Photographs.

The Missouri Pacific is to have a handsome exhibit in the United States Government Building at the Pan-American Exhibition in Buffalo next summer in the shape of an elaborate display of 100 photographs of scenery along the line of the Missouri Pacific and the Iron Mountain. These pictures, handsomely framed, have been prepared by the passenger department of the road, and the collection embraces views of every character, from the quiet cattle scene of Arcadian simplicity to the active life of the smelters and mines in the mineral regions; from the peaceful model farms to the rugged beauty of the Ozarks.

Railroading in Siam.

Siam's railroad, 78 miles long, from the capital at Bangkok to Glenkoi, was built and worked by the Prussian engineer Bethge until his sudden death by cholera in 1899, and is now managed by another Prussian engineer, Gehrts. In the year ending with March, 1900, this road earned at the rate of $4,338 per mile (though probably the currency was silver), which was 31 per cent. more than the year before; and the net earnings were $1,865 per mile. The traffic was equivalent to a daily movement each way of 188 passengers and 47 tons of freight. The average fare was 2.12 cents per mile; the average freight, 4.16 cents per ton per mile, which may account for there being so little of it. The net earnings were 2.9 per cent. on the capital expended. Work is progressing on an extension of 34 miles. Since March of last year, the first-class has been abolished, as only ¼ per cent. of the travelers made use of it, while 99.07 per cent. traveled third-class.

A New Electric Line in Brazil.

A project is on foot for building an electric railroad from Piracicaba to Villa Americana, in the State of São Paulo. The last-named station is in the old American colony of Santa Barbara. The estimated cost of the line is said to be $2,500,000. Permission to build it has been asked of the São Paulo Legislature.

A Russian Tramway.

A Belgian company has just been formed with a full paid capital of 3,000,000 francs, to build a tramway in the city of Krementchug, a town in the Government of Pultova, Russia. The place is a commercial center and has a population of 65,000.

Value of Railroad Property.

Prof. Henry C. Adams, of the University of Michigan, has completed a report on the value of the non-physical element in the railroad properties of the state, for the Michigan board of tax commissioners. This report is coordinate with the report made by Prof. Mortimer E. Cooley, of the department of mechanical engineering, regarding the value of the physical element in such properties.

Korean Railroads.

A scheme is under way to build a railroad from Seoul to Witsu, on the frontier of Manchooria. A Berlin paper reports that the concession for this line, which had been granted to a French syndicate, has been withdrawn, as the Frenchmen did not start work on the line in the time agreed upon. Korea had agreed to employ exclusively French engineers in the construction, and to import the material and rolling stock from France. The line was to be connected with the Great Siberian Railroad, and would have had a great influence upon the development of the ports of Fusan and Chemulpo. A delay in the construction of this line would, however, give a great advantage to the Russian port of Jalienwan.

Some Electric Power Transmission Difficulties.

Mr. I. R. Edmands, writing on this subject, in *Cassier's Magazine*, for February, says in part: "Probably the most exasperating cause of trouble with bare overhead lines is the small boy with a piece of hay-bale wire which he tosses up to see the fireworks. The great display is liable to strike terror to his heart and impress him with the enormity of his crime, so that he will not do it again; but it is possible for an apparently infinite number of boys with the desire to see fire to live within the neighborhood of a 30-mile line, and it is difficult to locate a boy after his desire has been satisfied. After once getting started, an arc, under proper conditions, will hold across a surprisingly long distance. A number of instances are recorded of an arc holding between conductors 18 in. apart on a 10,000-volt line for a length of time sufficient to completely burn off a 350,000-circular mil. cable. A peculiar instance was once observed of an arc, after being started between conductors, continuing to hold while the wind blew it along the line, producing an effect similar to a meteor traveling parallel to the earth's surface. The distance between the conductors on this line was 18 in., but this was changed to 36 in. to overcome this and other troubles."

An Up-to-Date Compromise.

The Railroad Commissioners of Iowa have decided the case of the citizens of Le Grand vs. the Chicago & Northwestern, in which the people demanded that the company move its depot into the town. At present the station is about a mile from the town. It is on a level grade and the railroad descends both ways from this level. The company objected to removal because the station would have to be placed at the foot of a heavy grade, and would thus impede and endanger passenger traffic and interfere with freight traffic. The Commissioners decided that the building should be moved 800 ft. nearer the town, which would still leave it on the level grade, and that the company should maintain a telephone line between station and the town; and also should expend $300 in improving the road between the town and station.

LOCOMOTIVE BUILDING.

The Wheeling & Lake Erie has ordered six switching and four consolidation engines from the Pittsburgh Locomotive & Car Works.

The Chicago, Lake Shore & Eastern has ordered three switching engines from the Pittsburg Locomotive & Car Works. They will weigh 119,000 lbs. and have 19 in. x 26-in. cylinders; 50-in. drivers and straight top boilers, with a working steam pressure of 180 lbs. The special equipment includes Buckeye couplers.

The Mogyana, of Brazil, has ordered one engine from the Baldwin Locomotive Works.

The Ohio River has ordered five locomotives from the Manchester Locomotive Works.

CAR BUILDING.

The Lake Shore & Michigan Southern is in the market for about 1,500 cars.

The Louisville & Nashville has ordered 250 box cars from the Mt. Vernon Car Mfg. Co.

The Delaware, Lackawanna & Western, it is reported, is in the market for freight car equipment.

The Baltimore & Ohio, it is reported, has ordered 1,500 cars from the South Baltimore Car Works.

The Buffalo, Rochester & Pittsburgh has ordered 500 coal cars from the American Car & Foundry Co.

The Standard Butterine Co., of Washington, D. C., is reported in the market for 170 refrigerator cars.

H. M. McIntosh, 502 Great Northern Bldg., Chicago, has ordered 100 refrigerator cars from the American Car & Foundry Co.

The Rutland, we are officially informed, has not yet signed the contract for 1,000 freight cars with the Pullman Co., as reported recently. The matter is now under consideration and it is expected the details will be decided in a few days.

The Chicago, Burlington & Quincy has ordered 1,000 stock cars from the American Car & Foundry Co., and 500 coal cars from the Illinois Car & Equipment Co. The stock cars will be 36 ft. long and have a capacity of 50,000 lbs. The coal cars will be of 80,000 lbs. capacity, will weigh 31,000 lbs. and measure 37 ft. long. McCord journal boxes will be used.

The Chicago, Lake Shore & Eastern order with the Pressed Steel Car Co., mentioned last week, calls for 150 steel gondola cars of 100,000 lbs. capacity, for August delivery. They will weigh 36,500 lbs. and measure 43 ft. long, 10 ft. wide and 4 ft. high. The specifications include Pressed Steel bolsters and brake-beams, Corning brake-shoes, Buckeye couplers and Miner draft rigging.

The New York Central & Hudson River has ordered no cars for passenger service recently, as stated in newspaper reports. Many months ago the road ordered 25 special cars for use on the belt line around Buffalo during the Pan-American Exposition, and later contracted with the Harlan & Hollingsworth Co. for 25 standard 61-ft. passenger coaches, without vestibules, which order was afterward increased to 75. Part of these have been received and the balance are to be delivered before June.

The Illinois Central order with the American Car & Foundry Co., referred to last week, calls for 1,000 box cars of 80,000 lbs. capacity, for May and June delivery. They will weigh 37,200 lbs. and measure 40 ft. long inside, 8 ft. 6 in. wide and 7 ft. 4½ in. high. Wood will be used throughout. The specifications include Common Sense bolsters, Westinghouse brakes, Chicago couplers, Security and Dunham doors, Thornburgh draft rigging, M. C. B. journal boxes, Chicago roofs, Scott springs for trucks, A. French springs for drawbars, and Fox and Kindl trucks.

BRIDGE BUILDING.

ALBANY, N. Y.—The committee appointed to arrange for a driveway on the new Livingstone avenue bridge over the Hudson River, reported to the Rensselaer Common Council Feb. 5.

No definite action has as yet been taken regarding the Broadway viaduct.

ALLEGHENY, PA.—Bonds have recently been sold for the proposed new bridge on Geyer avenue, over Woods

River, which will cost about $90,000. It will be about 700 ft. long and 50 ft. wide. Robert McAfee, Director Department of Public Works; G. C. Langeheim, Superintendent Bureau of Engineering.

The long and high trestle at Jacks Run, on the Ohio Connecting (Pennsylvania Lines) will be replaced by a steel structure.

ARKANSAS.—The House, on Feb. 9, passed a bill authorizing the Jonesboro, Lake City & Eastern R. R., a railroad incorporated under the laws of Arkansas, its successors or assigns to build a drawbridge across Little River at or near the mouth of Big Lake in Mississippi County, Ark.

ASHLAND, KY.—Last week we reported that the Ashland & Ironton Bridge Co. had announced its intention of building a bridge over the Ohio River at Ashland. We are told that the width of the river at the place where the bridge is to be built is 1,825 ft. and it is estimated that the bridge, which is to be a general highway and railroad bridge, will cost about $1,200,000. Plans are now being made.

BALTIMORE, MD.—The Baltimore, Halethorpe & St. Denis Electric Ry., a new road, proposes to build a bridge over Gwynns Falls.

BARBERTON, OHIO.—The Brackett Bridge Co. has a contract for the 960-ft. plate girder bridge over the Tuscarawas River, Ohio Canal and the tracks of the C. A. & C. and the B. & O., for the Barberton Belt Line R. R. (Feb. 8, p. 101.)

BAY CITY, MICH.—The councils of Bay City and West Bay City are considering building a bridge over Saginaw River at Twelfth street.

BRIDGEPORT, CONN.—It is stated that the New York, New Haven & Hartford will, in the spring, begin work toward eliminating the grade crossings in Bridgeport, which includes trestle work, a large swing bridge and a new passenger station.

CHICAGO, ILL.—The City Council has passed the ordinance for the track elevation on Kinzie street. The work will require 12 subways as follows: Under the tracks of the Panhandle and Northwestern roads at North Western avenue, North Oakley avenue, North Leavitt street, North Hoyne avenue, North Robey street, North Lincoln street, North Wood street, North Paulina street and North Ashland avenue; under the St. Paul tracks at Artesian, West Chicago and North Kedzie avenues and Central Park boulevard.

DAVENPORT, IOWA.—The ordinance passed by the Council for elevating half a mile of the Chicago, Rock Island & Pacific in the city provides for a viaduct with concrete walls and openings at all streets intersected; also for a new passenger station and office building.

DETROIT, MICH.—The Michigan Central has recently let contracts for a plate girder bridge to carry the railroad tracks over Woodward avenue, Detroit, to the Detroit Bridge & Iron Works at 2.45 cents per pound, f. o. b. cars, for about 410,000 lbs. The bridge has three sidewalks and consists of a through plate girder span 54 ft. long over the roadway, and a 12-ft. span over the sidewalk, to be used jointly by the Lake Shore and the Michigan Central roads. The Grand Trunk Ry. also crosses Woodward avenue at this point and its bridges will be similar to the above except that it is a single track. The contract for this bridge is also let to the Detroit Bridge & Iron Works.

ENDEAVOR, WIS.—A steel bridge is proposed across the Fox River, about a mile east of this village. The Government Engineer recently viewed the site.

FAIRPORT, N. Y.—A lift bridge is proposed to replace the present old bridge over the Erie Canal at Church street. A bill is before the Legislature appropriating $25,000 for it.

FARGO, N. D.—The bill authorizing a bridge across the Red River of the North has been signed by the President. (Jan. 25, p. 67.)

FORT WAYNE, IND.—The American Bridge Co. has the contract for the bridge works on the Fort Wayne & Southwestern Traction Co., which includes a 170-ft. bridge over St. Mary's River. (Jan. 18, p. 49.)

FORT WORTH, TEX.—The Fort Worth & Dallas Interurban Electric Ry. is receiving bids for bridges and material for its proposed eight miles of road.

GENEVA, ALA.—The Senate has passed a bill authorizing the Louisville & Nashville to build a bridge across the Choctawhatchee River. Construction must be begun within one year after the plans are approved by the Secretary of War. Other railroads may use the bridge on payment of reasonable compensation.

GENEVA, N. Y.—The New York Central & Hudson River has let the contract for bridges on the Fall Brook District and Geneva to Newberry Junction, Pa.; also on the Beech Creek District, to the American Bridge Co. (Dec. 28, 1900, p. 866.)

GLASSPORT, PA.—John P. McIntyre, of McKeesport, Pa., informs us that he would like to hear from bridge builders and masonry men relative to building a steel bridge over the Monongahela River at Glassport, just above McKeesport. Congress has recently passed a bill authorizing the Glassport Bridge Co., in which Mr. McIntyre is interested, to build this bridge.

GREAT FALLS, MONT.—Contracts for the bridge over the Missouri River at Great Falls are let as follows: Steel superstructure to the Toledo Bridge Co., and the masonry substructure to Grant, Smith & Co., Chicago, Ill. The bridge is to have a total length of 1,066 ft. and will cost about $200,000.

INDIANAPOLIS, IND.—New bids are wanted, March 1, for two bridges over Fall Creek. Bids are also wanted for a bridge over White River at Raymond street. (Feb. 1, p. 86; Feb. 8, p. 101.)

JACKSON, MICH.—The Detroit & Chicago Traction Co. will build a $15,000 bridge seven miles east of Jackson, according to report.

KINGSTON, TENN.—The bill authorizing the Kingston Bridge & Terminal Co. to build a bridge across the Clinch River has passed both the House and Senate.

LINWOOD, KAN.—A bridge is proposed over Kaw River at Linwood for which a bill is before Congress.

MINDEN, N. Y.—A bill has been introduced in the Legislature for an appropriation for a steel bridge over the Otsquago Creek, in the town of Minden.

MONTGOMERY, ALA.—A bill was introduced in the U. S. Senate Feb. 8 and referred to the Committee on Commerce authorizing the Montgomery & Autauga Bridge Co. to build a bridge across the Alabama River, near Montgomery.

MONTICELLO, MISS.—A bill has been introduced in the House of Representatives authorizing a bridge across Pearl River, at Monticello, Miss.

MORGANTOWN, W. VA.—The Cassville & Monongahela R. R. will need a bridge over the Monongahela River for which plans are not made. James A. Milholland, of Cumberland, Md., is interested.

NEW BEDFORD, MASS.—The contract for the metal work for the new Fairhaven bridge is let to the American Bridge Co. (Feb. 1, p. 86.)

NEW YORK, N. Y.—A bill has been introduced in the Legislature for a bridge to be used as a public street across the Jerome Park reservoir, Borough of Bronx, connecting Jerome and Sedgwick avenues.

NIAGARA FALLS, N. Y.—It is proposed to have the tracks of the Suspension Bridge R. R. pass over the Erie tracks by a viaduct at Pine street. The Railroad Commissioners recently gave a hearing in Buffalo.

A hearing will be given in Rochester on Feb. 16 regarding the elimination of the grade crossing of the Central and the Erie roads at 19th street, Niagara Falls.

OWEGO, N. Y.—The Black Lake Bridge Co. has been incorporated, with a capital of $40,000, by Ellery Colby, E. R. Booth and T. H. Reddish, all of Owego.

PERTH AMBOY, N. J.—At a meeting of the Board of Freeholders of Middlesex County, plans were considered for building a bridge over Raritan River between Perth Amboy and South Amboy.

PITTSBURGH, PA.—A $40,000 stone tunnel will be built under the tracks of the Pennsylvania at the village of Edgewood. It will be 40 ft. wide.

QUEBEC, QUE.—W. D. Baillaye, Assistant City Engineer, will receive bids until Feb. 27 for an iron bridge over St. John street.

READING, PA.—The Reading & Southwestern Street Ry. has agreed to build the approaches to the projected bridge at Front street and the Lebanon Valley R. R., which will cost $15,000. Alex. Murdoch, City Engineer.

ST. CATHARINES, ONT.—The City Clerk informs us it is proposed to replace the antiquated Queenston street bridge with a steel structure for horse, foot and trolley traffic. The bridge crosses the Grand Trunk Ry. and the Niagara, St. Catharines & Toronto (trolley) Ry., which are quite close together. Negotiations are pending as to the allotment of cost, but no design has yet been accepted. Jno. S. McClelland, City Clerk.

ST. MARY'S, ONT.—The County Council, according to report, will build a bridge on the county line between South Earthope and East Zorra; also a new bridge to replace the Wallsee-Howick bridge.

SCRANTON, MISS.—The Board of Supervisors has approved the plans and specifications of the Geo. E. King Bridge Co. for the steel bridge over Fort Bayou at Ocean Springs. It is to be 380 ft. long and have a draw of 130 ft. The contract will be let at the next meeting of the Board.

The Board authorized the clerk to advertise a sale of $10,000 of bonds to pay for new steel bridges in various parts of the county.

SHEDIAC, N. B.—The Shediac Coast Ry. will need two bridges of about 100-ft. span across the Abonshagan and Kouchibouguac Rivers and an arch across the Tidnish River, between Shediac and Shemouge. (See Railroad Construction column.)

SIOUX CITY, IOWA.—Two new bridges are to be built in this city this year. One will be a steel structure across the Floyd River about three-quarters of a mile east of Leeds, to replace what is known as the Austin Bridge.

The other bridge is to replace the frame structure across Perry Creek in Third street, and is to be a steel girder.

SPOKANE, WASH.—The Chelan Transportation & Smelting Co. will need one bridge and one trestle on a proposed railroad. Thomas Malony, Secretary, Jamieson Bldg., Spokane.

SUMMERVILLE, PA.—J. C. Whitla, President of the Clairon & Summerville R. R., tells us he will receive bids on April 1 for a 250-ft. steel bridge over the creek and ravine at Summerville. His address is 314 Fourth avenue, Pittsburgh, Pa.

TEXARKANA, TEX.—The Eastern Texas, a new road being built by the Central Coal & Coke Co., will need one steel bridge of 120 ft. span across the Neches River.

TEXAS.—A bill has been introduced in the House, and referred to the Committee on Interstate and Foreign Commerce authorizing the Paris, Choctaw & Little River Ry. to build a bridge across Red River.

WOODSTOCK, ONT.—The County Council will build a steel bridge between Deereham and West Oxford, according to report.

Other Structures.

ATLANTA, GA.—The Southern Ry. will build a new freight house at Atlanta.

The Atlanta Steel Hoop Co. was recently incorporated, with a capital stock of $50,000, with the privilege of increasing it to $250,000, to build an iron and steel works in Atlanta. The incorporators are: C. E. Currier, G. W. Connor, Frank H. Hawkins and others.

CHICAGO, ILL.—We are informed by the Lake Shore & Michigan Southern that no plans have as yet been agreed upon for a new station in Chicago.

DAVENPORT, IOWA.—See Bridge Building.

GRAND RAPIDS, MICH.—The Grand Rapids Malleable Iron Co. will enlarge its plant in the spring.

MECHANICVILLE, N. Y.—The Boston & Maine machine shops and roundhouse at Mechanicville were burned Feb. 11. The loss is estimated at $250,000.

NEW YORK, N. Y.—Fire in the Flatbush avenue car barns of the Brooklyn Rapid Transit Co., on the evening of Feb. 8, destroyed the structure and about 150 trolley cars and several snow plows. President Rossiter, a few days after the fire, announced that it is proposed to build a new car barn on a different site, but that nothing definite has been decided.

OMAHA, NEB.—Fire destroyed a car barn and 60 trolley cars of the Omaha Street Ry. on the night of Feb. 8.

PITTSBURGH, PA.—The Crucible Steel Co. of America has let a contract to Mackintosh, Hemphill & Co. for rolls, engines and blooming mill machinery to the amount of about $150,000, for the new open-hearth steel plant the St. Clair Steel Co. will build at Blair Station.

SALT LAKE CITY, UTAH.—The Council has granted the Rio Grande Western permission to build new shops. Reports state that the railroad has the plans finished and that work will soon be begun on a large electric power plant.

STRUTHERS, OHIO.—The American Sheet Steel Co. will build two additional sheet mills at its plant here.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

Western Society of Engineers.

At a meeting of the Western Society of Engineers, Wednesday evening, Feb. 13, in Fullerton Hall, the Art Institute, Chicago, there was an open discussion on the Chicago River. Mr. T. T. Johnston, formerly with the Sanitary District, read a paper on the subject.

Civil Engineers' Society of St. Paul.

At the meeting of the Civil Engineers' Society of St. Paul, Minn., held Feb. 4, the following officers were elected: President, A. O. Powell, Assistant Engineer, United States; Vice-President, A. W. Munster, Bridge Engineer, Chicago Great Western Railway; Secretary, G. S. Edmondstone, City Bridge Engineer, St. Paul; Treasurer, A. H. Hogeland, Resident Engineer, Great Northern Railway; Librarian, C. A. Winslow, City Engineer's office, St. Paul; representative on Board of Managers for Association of Engineering Societies, George L. Wilson, Assistant City Engineer, St. Paul. Two new members were elected. The meeting night has been changed from first to second Monday in each and every month.

Mr. H. J. Gillie, Superintendent Edison Electric Light Co., described the terminal station within the limits of the city of St. Paul for the electric current generated at the power house at Apple River. Afterward members inspected the terminal station.

Engineers' Club of Philadelphia.

A regular meeting of the club will be held on Saturday, Feb. 16, at 8 p. m. The papers are: "Variations and Uses of the Standards of Measurements Employed in Field Engineering," by Benjamin Franklin. "Criticisms on Land Surveying as Practiced by Civil and Mining Engineers," by A. V. Hoyt.

At the meeting on Feb. 2 Mr. Charles Piez presented the first paper of the evening on chains and chain gearing. After pointing out the advantages of machine-made over cast chains and sprocket-wheels in transmitting power, the desirability of lubrication was pointed out and several devices were described which have been adopted where lubrication was practically impossible. The theory and actual operation of the action of the links of a chain meshing into the teeth of a sprocket-wheel were considered, with the aid of lantern illustrations, for various forms of sprocket and chain. It was pointed out that when the rapidly increasing destructive effect of blows at high speeds is taken into account, there is a maximum speed beyond which the effective power that can be transmitted by a given chain will rapidly decrease, the maximum speed for a malleable chain being 500 ft. per minute. Mr. Piez then described in considerable detail a silent chain-gear invented by Mr. Hans Reynold, of Manchester, England, by which it is possible to attain speeds of even 1,500 ft. per minute with as little noise as accompanies the action of a leather belt. A large sprocket-wheel and several different styles of this chain were exhibited. The subject was discussed by Messrs. Henry S. Spackman, L. Y. Schermerhorn and others.

The second paper of the evening, on "A Plant of By-Product Coke Ovens," was written by Mr. William H. Blauvelt, Manager of the Semet-Solvay Co., and described a plant of retort coke ovens at Wheeling, W. Va., with illustrations projected by the lantern. The general subject of the utilization of the by-products from the production of coke was discussed by Messrs. Joseph T. Richards, George C. Davis, H. W. Jayne, E. M. Nichols, Henry Leffmann and others.

Engineers' Club of St. Louis.

The 520th meeting was held at 1600 Lucas place Feb. 6, President Spencer presiding. Thirty members and 14 visitors were present.

President Spencer presented a draft of an "Act prohibiting the discharge of dense black smoke from any premises within the limits of all cities of the State of Missouri having a population of 300,000 inhabitants." This, together with a memorial to the General Assembly, was offered by the Chairman of the Committee on Smoke Prevention, with the suggestion that the members of the club sign the same. Upon discussion it developed that Mr. Moore, Chairman of the Smoke Prevention Committee, preferred to have the memorial signed in the name of the club by its officers. Upon motion made and duly seconded it was ordered that the President sign and the Secretary attest the memorial.

The subject for the evening was an informal address by Mr. Arthur Thacher, President of the Central Lead Co., and the Renault Lead Co., on "Lead Mines in Missouri." The speaker discussed the geological features of the three lead districts of this state, taking up separately the Southwest Missouri district, the Central Missouri district, and the Southeast Missouri district. Particular attention was given to the mines of the latter district as they produce by far the greater proportion of the lead of the state. The speaker explained, in a brief but clear and interesting manner, the various steps followed in the production of lead in this district, beginning with prospecting for the mineral and following the movement of the rock in its course through the mill, whose product is the concentrate. Then following the concentrate through the roasters and smelters, ending with the purified pigs of lead. A number of interesting views of mining properties and ore-bearing rock were shown. The speaker extended a very cordial invitation to all members to visit the mines of the Central Lead Co. in order to better acquaint themselves with the nature of the very valuable and extensive lead deposits in this district.

The Chair announced as the subject of the paper for the next meeting, Feb. 20, "A Historical Description of the Bridges Over the Mississippi," illustrated by lantern slides, by Mr. F. B. Maltby. It was decided that this meeting be an open one, and that members be requested to bring their friends and make special effort to have a large attendance of ladies.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. James M. Reynolds, at one time General Manager of the Louisville, New Albany & Chicago (now the Chicago, Indianapolis & Louisville), died suddenly at Lafayette, Ind., Feb. 3.

—Mr. H. W. Schmidt, Superintendent of the Illinois Southern, died at Sparta, Ill., Feb. 11. His son died Feb. 9 and Mrs. Schmidt is dangerously ill. It is supposed they were poisoned by eating canned beef.

—Mr. B. W. Folger, Jr., whose appointment we noted two weeks ago as General Superintendent of the Brooklyn Rapid Transit, is 30 years old, and for the past 10 years has been in charge of certain transportation business in connection with the New York Central & Hudson River.

—Mr. Albert S. Ingalls becomes Superintendent of the Cleveland and Indianapolis divisions of the Cleveland, Cincinnati, Chicago & St. Louis. He was born in Cincinnati, Ohio, Feb. 27, 1874, and after taking a degree at Harvard in 1896, he was appointed a clerk in the office of the General Manager. In September of the following year he was made Assistant Superintendent of the divisions of which he now becomes Superintendent.

—Rear Admiral Peter A. Rearick, Engineer Corps, U. S. Navy (retired), was found dead in bed from heart disease on Feb. 9 at his home in Washington, D. C., aged 63 years. Admiral Rearick was appointed a Third Assistant Engineer in the Navy from the District of Columbia in February, 1860. From 1862 to 1886 he served in the North Atlantic, South Atlantic, Pacific, European and Asiatic squadrons. In 1874 he was made a Chief Engineer. His last duty was at Newport News, where he was Inspector of Machinery from May, 1886, until his retirement for age, on Feb. 17, 1900.

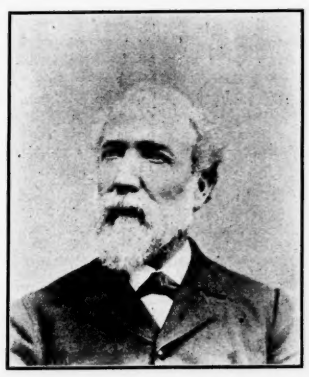
—Mr. Frederick Harvey, Manager of the Eating Houses on the Atchison, Topeka & Santa Fe, died last week at Leavenworth, Kan. Mr. Harvey had managed the eating houses along the line of the Santa Fe since 1882, and was probably the best known man engaged in that line of business in this country. From a small beginning he had built up a very large business and at the time of his death he conducted 45 hotels and eating houses, besides 20 dining cars on the Santa Fe, of which he took charge about two years ago. The Santa Fe eating houses under Mr. Harvey have enjoyed a high reputation.

—Mr. M. M. Martin, Superintendent of the Car Department of the Wabash Railroad, died recently at his home in Litchfield, Ill. He was born in 1831 at Sussex, England, and entered railroad service in 1851 as foreman on the Michigan Southern & Northern Indiana. Later he became Master Car Builder on the St. Louis, Alton & Terre Haute and in 1865 held a similar position on the Ohio & Mississippi. In 1880 he became Vice-President of the Litchfield Car & Machine Company and four years later Superintendent of the Car Department of the Wabash. Mr. Martin was a member of the Master Car Builders' Association of the United States.

—Mr. H. C. Pearce, the new Purchasing Agent of the Minneapolis, St. Paul & Sault Ste. Marie, was born in Canada June 1, 1865. He entered the service of the Minneapolis, Minnetonka & Lyndale Railway Company in 1884, serving as brakeman, conductor and cashier. He became a clerk for the Superintendent of Construction for his present company, the Minneapolis, St. Paul & Sault Ste. Marie in September, 1887. After the road was built, he was transferred first to the Auditor's office, and then served for two years as chief clerk to the General Superintendent. He was appointed General Storekeeper Sept. 1, 1892. His appointment as Purchasing Agent took effect Jan. 25 last.

—Mr. A. Hilton, whose appointment was recently noted as Assistant General Passenger Agent of the Kansas City, Fort Scott & Memphis, has spent nearly all his railroad life in the service of the Chicago & Alton. Mr. Hilton was born at Hamilton, Canada, June 19, 1863. He entered the service of the Great Western of Canada, now a part of the Grand Trunk, in 1877. Two years later, on April 8, he took service with the Chicago & Alton as junior clerk, and served in various clerical capacities in the general ticket office until Dec. 16, 1884, when he became City Ticket Agent at Kansas City, Mo. In March, 1887, he was appointed Acting Pacific Coast Agent at San Francisco. In 1891 he became General Agent of the Passenger Department at Kansas City, and still continues in that position. The change to the Kansas City, Fort Scott & Memphis takes effect March 1.

—Mr. William C. Baker was killed Feb. 6 by a train on the New York & Greenwood Lake Division of the Erie near Upper Montclair, N. J. He was on his way to the station to take a train for New York when he was hit by the train and died almost immediately. Of course, the readers of the *Railroad Gazette* are very familiar with the name and work of Mr. Baker, who at the time of his death was carrying on business in his own name as successor to the Baker Heater Company. He was born in Dexter, Me., on July 25, 1828. The early years of his life were spent in Maine, and he went to New York city about 50 years ago. Mr. Baker claimed to have been and probably was the originator, inventor and first patentee of the system of heating cars by hot water circulation, and was the founder of the firm of Baker, Smith & Co. After retiring from that firm, he was one of the promoters of the New York Steam Heating Co. Later he went into business in his own name, with offices in New York and factory at Hoboken. He not only originated the famous Baker heater, but designed apparatus to use steam from the locomotive for heating passenger cars by hot water circulation, and his system is now used extensively in this country and abroad. He was the inventor of the safety explosive vent now very generally used, and during his career had granted to him 45 patents. He was well known in all railroad circles. Mr. Baker was a widower, and is survived by two daughters. His home was on the Palisades, but he was spending the winter at Upper Montclair, N. J., with his married daughter. A host of railroad men will remember well his striking countenance and his resolute enthusiasm in pushing forward the enterprises which have added so much to the comfort and security of all who travel by rail.



—Mr. E. E. Scranton is General Manager and Superintendent of the Ohio River & Lake Erie at Alliance, Ohio. He was born in Deerfield, Ohio, March 2, 1840, and from Mount Union College entered railroad service in September, 1872, as a freight and ticket clerk for the Pittsburgh, Fort Wayne & Chicago at Alliance, Ohio. He continued with that company and the Cleveland, Youngstown & Pittsburgh until Feb. 1, 1887, when he was made Superintendent of the Lake Erie, Alliance & Southern, and has remained with that company through its various changes. He was General Manager from April, 1891, for this company and also the Alliance & Northern, which earlier formed a part of the system. He was Receiver of the Lake Erie, Alliance & Southern between Nov. 6, 1894, and Nov. 6, 1897, and when the Ohio & Lake Erie was organized out of the old company, he continued as General Manager of the Alliance & Northern. He now adds to the office that of Superintendent of the Ohio River & Lake Erie.

ELECTIONS AND APPOINTMENTS.

Boston & Maine.—Walter W. Hodgkins has been appointed Assistant Master Mechanic of the Fitchburg Division, with headquarters at Mechanicville, N. Y., succeeding Edward Elden, resigned. Henry C. Manchester becomes Master Mechanic at Worcester, Mass., succeeding Mr. Hodgkins, effective Feb. 1.

Buffalo & Susquehanna.—H. H. Gardiner has been appointed General Freight and Passenger Agent, with headquarters at Buffalo, N. Y., succeeding H. C. Underhill, resigned. Effective Feb. 1.

Canadian Pacific.—G. J. Bury, Superintendent of the Western Division at Fort William, Ont., has been transferred as Superintendent at Cranbrook, B. C., succeeding J. A. Cameron, transferred. D. G. Ross, Assistant Superintendent at Winnipeg, Man., succeeds Mr. Bury at Fort William, Ont.

Chicago & Alton.—C. Hine, Assistant Superintendent at Roodhouse, Ill., has resigned.

Chicago, Burlington & Quincy.—William Hoppe has been appointed Superintendent of Bridges and Buildings of the Burlington Division at Burlington, Ia.

Chicago, Milwaukee & St. Paul.—R. R. Bradley has been appointed Mechanical Engineer.

Chicago Short Line.—The officers of this company are: President, M. C. Armour; Vice-President, D. B. Meacham; Secretary and Treasurer, E. L. Billingslea, and General Manager, C. L. Lingo. (See R. R. Construction column, Dec. 14, 1900, p. 834.)

Chicago Terminal Transfer.—Angus Brown, formerly Superintendent of Motive Power of the Wisconsin Central, has been appointed Superintendent of Motive Power of the C. T. T., with headquarters at Chicago, Ill.

Detroit & Chicago Traction.—The officers of this company referred to in the Construction column are: President, Wm. A. Boland, 31 Nassau street, New York; Vice-President, P. H. Flynn, New York: Treasurer, Fred C. Cocheu, New York; Secretary, W. A. Foote, Jackson, Mich.

Erie.—H. F. Coyle has been appointed Assistant Superintendent of the Mahoning Division, with headquarters at Youngstown, Ohio, effective Feb. 1.

Intercolonial.—E. G. Russell, formerly General Superintendent of the Delaware, Lackawanna & Western, has been appointed Manager of the Operation of the Intercolonial.

Kansas City, Parkville & St. Joseph Electric.—The officers of this company, recently referred to in the Construction column (Jan. 25, p. 69) are: President, Geo. W. York, Cleveland, Ohio; Vice-President, H. B. McAfee, Parkville, Mo.; Secretary, N. B. Hasbrouck, Cleveland; Treasurer, Geo. B. Dennison, Cleveland.

Pittsburgh, Shawmut & Northern.—B. E. Cartwright, heretofore General Manager, has been elected Fourth Vice-President. The duties of General Manager will be assumed by the President.

San Francisco & San Joaquin Valley.—G. Holterhoff, Jr., heretofore Treasurer, has been elected Secretary, succeeding A. Mackie.

Tennessee Coal, Iron & Railroad Co.—The position of Second Vice-President, held by A. M. Shook, has been abolished.

Toledo, St. Louis & Western.—W. O. Thompson has been appointed Master Mechanic of the Toledo Division, with headquarters at Delphos, Ohio; the position of Road Foreman of Engines, previously occupied by Mr. Thompson, is abolished. Edward Elden becomes Master Mechanic of the St. Louis Division, with headquarters at Charleston, Ill. All employees of the Motive Power and Car Departments will report to the Master Mechanics of their respective Divisions, who in turn will report to the Superintendent of Motive Power and Equipment.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BALTIMORE & OHIO.—The report of the conference committee of the Senate and House on the bills for new terminals and track elevation for this company and the Baltimore & Potomac line of the Pennsylvania, was agreed to by the House on Feb. 7, and by the Senate on Feb. 2, and the bill is before the President for signature. (Feb. 1, p. 87.)

BRITISH COLUMBIA ROADS.—R. A. Dickson, of Ottawa, is applying to the Dominion Parliament to build a railroad from Cascade City west along the valley of the Kettle River, and north up the north fork of the Kettle River to Franklin Camp, and from thence west to Vernon City and to the city of Vancouver, B. C., with branches from Franklin Camp east to Arrow Lake, at the mouth of Eagle Creek, and from Grand Forks south to Carbon City; also branches to neighboring mining camps.

CENTRAL NEW ENGLAND.—The Supreme Court, on Feb. 7, handed down a decision against this company's application to complete its Tariffville branch through Montague Farm in the town of East Granby, Conn. A bill is before the Connecticut Legislature to extend the time limit for completing the road. (Dec. 28, 1900, p. 868.)

CHELAN TRANSPORTATION & SMELTING.—This company has made preliminary surveys for a railroad from the mouth of Railroad Creek, Lake Chelan, Wash., to run to its property at the Holden mines. Building will be done by the company. The maximum grades are 4 per cent. One bridge and trestle will be required. The company's headquarters are at the Jamieson Bldg., Spokane, Wash. Fred R. Thompson is President and R. D. Johnson, General Manager. E. C. Mallette, Adams House, Boston, is interested. (Official.)

CHESAPEAKE BEACH.—An officer confirms the report that Cogan Bros., Washington, D. C., have taken the contract for filling in all the trestles on the line, calling for the removal of between 300,000 and 350,000 cu. yds. of material, work to be begun not later than April 1. (Feb. 8, p. 103.)

CHICAGO, ROCK ISLAND & PACIFIC.—The City Council of Davenport, Iowa, has granted a franchise to the company to elevate one-half mile of its line through the center of the city, eliminating grade crossings at five streets and carrying its through tracks on a viaduct with concrete walls. The plans call for an expenditure of $350,000.

CHIPPEWA & NIAGARA FALLS ELECTRIC.—This company is applying for a charter under the Ontario electric railways act to build a line from the village of Chippewa, on the Niagara River, through the township of Stamford, village of Niagara Falls and the town of Niagara.

CHOCTAW, OKLAHOMA & GULF.—Contracts are reported ready for letting on the Oklahoma & Western extension from Weatherford, Okla. T., west toward Amarillo, Tex. (Construction Supplement, July 27, 1900.)

CLEVELAND, WILLIAMSTOWN & BELINGTON.—This proposed line is to run from a connection with the Williamstown Bridge & Terminal Company's line at Marietta, Ohio, forming connection with Cleveland, Ohio, and then running east from Williamstown, W. Va., via Harrisville, Troy and Weston to Belington, connecting with the Davis-Elkins system, about 110 miles. (Feb. 1, p. 87.) H. C. Henderson, President of the West Virginia Western Telephone Co., Williamstown, W. Va., is President; J. H. Lininger, Harrisville, W. Va., Secretary; and S. D. Brady, Clarksburg, W. Va., Chief Engineer. (Official.)

COLUMBIA & INLAND.—Preliminary surveys have been made for a railroad under the above title from a point near Arlington, Ore., on the Oregon Railroad & Navigation, to run south 40 miles via Olex and Clem to Condon. It is to run through a prairie country, with easy grades opening up fine wheat lands. The incorporators are: S. P. Barker, Condon, Ore.; W. J. Marriner, Fred. Tobey, W. S. Myers and W. J. Edwards. (Oregon Roads, Jan. 25, p. 70.)

DES MOINES, EASTERN & MUSCATINE.—A railroad is proposed under this title from Des Moines, Iowa, west about 150 miles through Polk, Jasper, Poweshiek, Iowa, Johnson and Muscatine counties to Muscatine, paralleling the main line of the Chicago, Rock Island & Pacific nearly the entire distance. It is proposed to have the people along the route cooperate in its building. The principal office is Des Moines. F. M. Hubbell, President of the Des Moines Union, and D. B. Lyons, both of Des Moines, Iowa, are back of the project.

DETROIT & CHICAGO TRACTION.—This company, entered heretofore as the Detroit & Chicago (Feb. 1, p. 88), has been organized to build within the coming year an electric railroad from Detroit, Mich., west to Battle Creek, with a view to further extensions westward. The capital stock is $4,000,000. The company has secured franchises in every city and town between Battle Creek and Ann Arbor, and owns private rights of way outside of the cities and villages. Building is already in progress between Jackson and Ann Arbor. Arrangements are entered into to lease the Jackson & Suburban Traction. The principal power station will be erected at Jackson, with sub-stations at Grass Lake, Chelsea, Dexter and Ann Arbor. The officers are given under Elections and Appointments. (Official.)

EASTERN TEXAS.—The company has completed surveys and let contracts on 28 miles, to be completed May 1, from Lurkin, Tex., to Kennard. The road is projected 20 miles further to Crockett. All rails and rolling stock have been bought. There are about 400 teams at work. One steel bridge will be required across the Neches River of 120-ft. span. (Feb. 8, p. 104.) W. H. Carson, of Texarkana, is General Manager, and F. W. Villisent, of Lufkin, Tex., Chief Engineer. The road is being built by the Central Coal & Coke Co., of Kansas City, of which R. H. Keith is President. (Official.)

ESSEX & KENT RADIAL.—A private right of way has been secured along the highway for this electric line from Windsor, Ont., via Middle Road to Chatham, 50 miles, with a branch from Mardstone to Leamington, 30 miles. The charter is pending in Parliament. Joseph H. Webb, of Washington street, Ypsilanti, Mich., is interested. (Feb. 1, p. 88.) Cleary & Sutherland, of Windsor, Ont., are applicants for the charter. (Official.)

GRAND RIVER, CASTLETON & LA SAL MOUNTAIN.—This company was incorporated in Utah, Feb. 1, with a capital stock of $1,000,000, to build an ore railroad from a point on the Grand River to run to the La Sal Mountains, about 20 miles. The incorporators are: George S. Mattison, Seth E. McLean, Lorenzo Hatch, John E. Pace and Charles F. Caswel.

GREAT NORTHERN.—Counsel Dudley, from Vancouver, B. C., reports that the G. N. is to build a branch up Big Sheep Creek Valley, in southeastern British Columbia, to tap mining properties on the west slope of Sophie Mountain.

HOCKING VALLEY.—Surveys are reported in progress for a line one mile long at Walbridge, Ohio, to connect this line with the Toledo & Ohio Central.

ILLINOIS CENTRAL.—President Fish is quoted as follows with reference to the increase of capital stock recently noted:

We intend to make that $6,000,000 go as far as it will in improving the system. Even our road in Minnesota, Dakota and Iowa will be built up to a certain extent, although the bulk of the improvements will be made to the main line between New Orleans and Chicago. Where the St. Louis business begins, at Carbondale, 56 miles north of Cairo, there a double track may be added just as the business out of Jackson this way demands the same thing being done. Our aim

will be to improve the passenger service between New Orleans and St. Louis and Chicago the best we know how. (Feb. 1, p. 88.)

JOPLIN, SPURGEON & TEXAS.—Preliminary surveys are made, according to report, for this railroad from Joplin, Mo., south about 10 miles to Spurgeon. Building is to be begun, it is said, as soon as location is made. H. E. Buckien, of Chicago, is President, and Wm. H. Rosencrans, Joplin, Chief Engineer.

KANSAS & SOUTHERN.—The contract is reported let for building the extension from Westmoreland, Kan., south about 35 miles through Myers Valley to Alma. (Dec. 14, 1900, p. 834.)

KANSAS CITY, FORT SCOTT & MEMPHIS.—An officer writes that there is no truth in the report that the company will extend its Belleville branch north to Carl Junction, Mo. (Feb. 1, p. 88.)

LEVIS ELECTRIC.—This company is applying to the Quebec Legislature for a charter to build a line from the town of Levis, Que., to points in the counties of Levis, Dorchester and Bellechasse.

LOUISVILLE, HENDERSON & ST. LOUIS.—An officer denies the report of a proposed extension of the line through a portion of Hancock County, Ky. (Feb. 8, p. 104.)

MACKENZIE VALLEY.—C. W. Wetmore, of St. John, N. B., has given notice of an application to the Dominion Parliament to build a railroad from Prince Albert, N. W. T., on the North Saskatchewan River, to a point north of the rapids of the Slave River, with power to extend to the boundaries of Alaska, and to build branches.

MISCELLANEOUS COMPANIES.—The Watonga Construction Co. was incorporated in New Jersey, Feb. 6, with a capital stock of $100,000, to build railroads. The incorporators are: Wm. H. Jenks, Philadelphia; Charles E. Ingersoll, Philadelphia, and Robert H. McCarter, Newark.

MISSISSIPPI ROADS.—The Farnsworth Lumber Co., of Benndale, is reported building a road to timber land near that city.

NASHVILLE, CHATTANOOGA & ST. LOUIS.—An officer writes that in addition to the spur of 4,000 ft. building to the mines of the Douglas Coal Co., at Dunlap, Tenn. (Dec. 14, 1900, p. 834), on which the grading is nearly completed, the company is building three other spur tracks in Tennessee, one to Reid's Hill, 4,000 ft., leaving the line at Tracy City, on which the track laying is nearly completed. Another runs to Clouse Hill, 3¾ miles long, located and grading in progress. It leaves the Tracy City branch three miles north of Tracy City. The third is a spur to the Atpontley Coal Company's mine, to be 1¾ miles long, leaving the Sequatchie Valley branch near College Station. The line is located and grading will be begun in a few days.

NEVADA-CALIFORNIA-OREGON.—Surveys are reported in progress for the extension from Termo, Cal., north 110 miles to Lake View, Ore.

NORFOLK & WESTERN.—An officer writes that there is no foundation in the newspaper report of an extension to Allegheny, Ashe and Watauga counties, North Carolina. (Feb. 1, p. 88.)

OHIO & KENTUCKY.—New contracts have been made for completing this company's line from Jackson, Ky., terminus of the Lexington & Eastern, to run northeast 26 miles to Walnut Grove. Mason, Hoge & Co., of Frankfort, have the tunnel work, and Dolan Bros., of Lexington, Ky., are doing the grading. Work is to be completed about March 1. (Construction Supplement, July 27, 1900.)

OHIO NORTHERN.—This company was incorporated in Ohio, Feb. 6, with a capital stock of $25,000, to build a steam railroad in Williams County, from Alvordton on the Cincinnati Northern and the Wabash, to run northwest about eight miles to Pioneer. The central office is Toledo. The incorporators are: A. C. Van Duesen, G. W. Kurtz, W. H. Cummer, J. W. Cable and Alva B. Caple.

OHIO RIVER & CHARLESTON.—Surveys are reported in progress for a line from Erwin, Tenn., to run west about five miles to Embreville.

ONTARIO ROADS.—The following railroads are applying to the Ontario Government for aid. (For most of these roads, see Construction Supplement):

Algoma Central, from Missenabie north to James Bay.

Manitoulin & North Shore, connecting the Manitoulin Island with Sudbury on the mainland, some 12 miles of which was built last year.

Manitou, Wabigoon & Minnetakie, from the Parry River northward crossing the C. P. R. at Wabigoon, east of Rat Portage, and reaching to Lake Minnetakie.

Nipigon, from Port Arthur or Nipigon station northward to Lake Nipigon.

Nipissing & James Bay, from North Bay northward to Lake Temiscamingue.

PENNSYLVANIA.—See Baltimore & Ohio.

PERRY COUNTY.—Surveys are reported in progress for the extension through Saville township, Perry County, Pa., and up Liberty Valley to connect with the Tuscarora Valley.

PITTSBURGH & LAKE ERIE.—This company has amended its charter so as to build a line from Haselton, Ohio, to Youngstown, to connect with the Lake Shore & Michigan Southern.

PORTLAND, VANCOUVER & YAKIMA.—An officer writes that the company has revised the location of its line from Daly Road, Wash., to Yacolt Prairie, 15 miles. Most of the right of way is secured and the company expects to begin building early in the summer. A careful examination of the surveys for 60 miles additional has been made and asuitable route determined upon. I. N. Gray, of Vancouver, is President. (Dec. 28, 1900, p. 868.)

POWELL'S MOUNTAIN MINERAL.—Surveys are reported in progress for this line in Tennessee, which is to be 95 miles long. The central office is Sneedville, Tenn.

QUEEN ANNE'S.—The company is reported to have let a contract to Wade, Sloan & Co., Baltimore, for its proposed extension from Queenstown, Md., west about 14 miles to Love Point, at the mouth of Chester River. It is to be completed by May 20. (Nov. 30, 1900, p. 802. See also Railroad News column.)

RED RIVER & TEXAS SOUTHERN.—This company has been incorporated, with a capital stock of $200,000, to build a railroad in Texas from Willis, on the Red River, to Fort Worth, with a branch from some point in Dallas County to the city of Dallas. The central office is Willis. The incorporators are: William Stix, Murray Carleton, Perry Francis, W. P. Kennett, S. A. Ashley, W. F. Kelly and James R. Deagan, all of St. Louis; Sam Lazarus and T. Lahadre, of Sherman, Tex., and John Summerfield, of Dallas.

ST. JOHN VALLEY.—C. N. Skinner, solicitor, is applying to the New Brunswick Legislature for a charter to build a line from the city of St. John, or from a point on the Canadian Pacific at or near Westfield, to Fredericton, following the valley of the St. John River; also from the north terminus of the proposed Woodstock & Centerville to St. Leonards, County of Victoria, to connect with the Restigouche & Western; and from St. Leonards to Edmunston; also to arrange for running powers over portions of the Canadian Pacific between Westfield and St. John, and from St. Leonards to Edmunston; also to acquire power to run over the St. John Valley & Riviere Du Loup and the Woodstock & Centerville railroads when built.

ST. LOUIS & SOUTHERN ILLINOIS.—This company was incorporated in Illinois, Feb. 11, with a capital stock of $50,000 to build a railroad from East St. Louis through St. Clair and Monroe counties to Moro Landing, on the Mississippi, and thence to Missouri Junction in Randolph County. The principal office is Chicago. The incorporators and first directors are: Blueford Wilson, James L. Cook, T. B. Gillen, G. H. Withrow and P. E. Warren, Springfield, Ill., and C. H. Bosworth, John W. Walsh, and Charles Weinland, Chicago.

SHEDIAC COAST.—This line has been surveyed from Shediac to Shemogue. There will be two bridges of about 100 ft. span across the Abonshagan and Kouchibouguac Rivers, and an arch across the Tidmish River, between Shediac and Shemogue. There will be stations at Barachois, Cape Bald and Shemogue, and flag stations at Gould's Road, Dupey's Corner and Portage. Judge A. S. Trueman, Shediac, is the President; and the following are interested in it: A. P. Barnhill, C. N. Skinner, St. John; A. B. Copp, Sackville; Dr. E. A. Smith and James McQueen, Shediac; and R. A. Irving, Buctouche. (Aug. 31, 1900, p. 588.)

SOUTHERN.—An officer writes that nothing is known as to surveys by his company from Clinton, Tenn., south to Loudon, as reported. (Feb. 9, p. 104.)

SOUTHERN PACIFIC.—An officer writes that nothing has been decided about laying the third rail on some of the narrow gage lines of the South Pacific Coast in Alameda, Cal. (Jan. 25, p. 70.)

TYLER.—This company has been incorporated in West Virginia, with a capital stock of $150,000, to build a railroad from Sistersville to West Union. The principal office is Sistersville. The incorporators are: H. W. McCoy, A. C. Jackson, W. J. Neuenschwander, E. A. Durham, H. E. Wilson, C. F. Hosford, J. H. McCoy, G. E. Work, C. Thistle, of Sistersville; S. G. Pyle, J. W. Grim, J. G. Mayfield, G. D. Smith, O. W. O. Hardman, D. Hickman, J. M. Underwood and W. E. Kirchner, of Middlebourne.

UNION PACIFIC.—An officer writes that there is no truth in the report that contracts are let for grade reductions at Athol Hill, south of Cheyenne, Wyo. (Feb. 1, p. 88.)

WHITE RIVER.—This company was incorporated in Arkansas, Feb. 9, with a capital stock of $1,950,000, to build a railroad from Batesville, northwest about 150 miles through Izard and Marion counties to a point on the state line south of Springfield, Mo. Geo. J. Gould is said to own most of the capital stock.

WOLFE, MEGANTIC & LOTBINIERE.—This company is applying to the Quebec Legislature for an act to build a railroad from Lime Ridge, in the county of Wolfe, to the site of the proposed Quebec bridge on the St. Lawrence, through the counties of Wolfe, Megantic, Lotbiniere and Levis, by way of the valley of the Thames River, with power to enter the city of Quebec.

YONKERS & WHITE PLAINS.—This company was incorporated in New York, Feb. 11, with a capital stock of $50,000, to build an electric line from Yonkers to White Plains. The incorporators are: Freeman H. Merritt and W. Jay Wilson, of White Plains; R. J. Bellew, B. B. Riley, H. I. Lent, W. J. Fisher, P. C. Merritt and J. E. Lattimer, of Tuckahoe, and Charles Husenberry, of Yonkers.

GENERAL RAILROAD NEWS.

ATCHISON, TOPEKA & SANTA FE.—The directors have sold an issue of $5,000,000 general mortgage 4's out of the $5,758,300 authorized. This is for capital expenditure prior to June 30, 1900. (July 13, 1900, p. 488.)

AUGUSTA SOUTHERN.—The Southern is reported to have bought a majority interest in the capital stock of the A. S., at $40 per share. The road was leased in perpetuity March 1, 1897, to the South Carolina & Georgia, which is leased in turn to the Southern.

BALTIMORE & LEHIGH.—Stockholders, on Feb. 12, ratified the agreement for the consolidation of this company with the York Southern, recently agreed to by that company. (Y. S., Feb. 8, p. 104.)

BALTIMORE & OHIO.—The directors, on Feb. 8, voted to issue $15,000,000 4 per cent. 10-year gold convertible debentures for building and improvements. Holders of voting trust certificates of record of Feb. 21 may subscribe until 3 p. m., Feb. 28 at par, at the rate of one debenture for every 70 shares of stock. These debentures may be redeemed at par and accrued interest on any interest day beginning March 1, 1902, in the inverse order of their numbers.

CALVERT, WACO & BRAZOS VALLEY.—The Texas Legislature has passed a bill authorizing the International & Great Northern to buy and operate this property on condition that the road be extended north to Fort Worth and south to Spring, Tex., near Houston, by March 1, 1905. (Railroad Construction, Dec. 7, 1900, p. 817.)

CENTRAL PACIFIC.—Notice has been given by the company of the intention to pay its note for $2,940,635 due the Government in February, 1902, one of the series issued in 1899 in settlement of the claims. This payment releases an equal amount of first refunding 4's deposited as collateral. (Oct. 20, 1899, p. 738.)

CHICAGO & SOUTHEASTERN.—Application was made in the Circuit Court at Brazil, Ind., Feb. 12, by fifteen creditors for the appointing of a receiver for this company. (Nov. 2, 1900, p. 732.)

CHICAGO SHORT LINE.—This company was incorporated in Ohio Feb. 6, with a capital stock of $75,000, to take over the properties of the Mansfield Short Line (Railroad Construction, Nov. 16, 1900, p. 764), now building from Shelby, Ohio, northwest 12 miles to Mansfield; also the Shelby & New Washington. The directors are: H. C. Hedges, W. S. Cappelle, Curtis E. McBride, C. W. French and C. D. Crouch, all of Mansfield.

COLUMBUS NORTHWESTERN.—See Toledo & Ohio Central.

ERIE.—Richard Pine-Coffin, on Feb. 7, applied to Justice Fitzgerald, of the Supreme Court, New York, for an injunction restraining the company from carrying out its agreement to buy the Pennsylvania Coal Co. (Jan. 25, p. 70.)

HOCKING VALLEY.—Forty-four Columbus, Hocking Valley & Toledo car trust series A, have been drawn for redemption at par and accrued interest April 1, at the Atlantic Trust Co., New York. (Aug. 10, 1900, p. 546.)

HOUSTON & TEXAS CENTRAL.—First mortgage bonds to the par value of $175,000, and consolidated mortgage bonds for $150,000 will be redeemed at the Mills Bldg., New York City, at 110 and interest, interest to cease March 31. (Nov. 9, 1900, p. 748.)

KANSAS CITY, FORT SCOTT & MEMPHIS.—The company has declared a dividend of 4 per cent. on the common stock, payable Feb. 15, the first dividend on the common since 1891.

MISSISSIPPI RIVER, HAMBURG & WESTERN.—This line, extending from Luna, Ark., to Hamburg, 40 miles, has been bought in the interest of the St. Louis, Iron Mountain & Southern line of the Missouri Pacific.

NEW ORLEANS & NORTHWESTERN.—Announcement is made that a controlling interest has been acquired by the St. Louis, Iron Mountain & Southern line of the Missouri Pacific, in this line which runs from Bastrop, La., to Natchez, Miss., 101.57 miles. Surveys have been made for an extension from Bastrop, La., north about 60 miles to Warren, Ark. (Construction column, Jan. 18, p. 52.)

NEW YORK & NORTH SHORE.—The New York Court of Appeals has sustained the decision of the lower courts ordering the removal of the incline on Liberty avenue, Jamaica, building by the Long Island Electric, to connect its tracks with the Kings County Elevated at the Crescent Avenue station.

PERKIOMEN.—The stockholders, on Jan. 14, voted to increase the capital stock to $1,500,000 and the new issue of $1,462,500 has been turned over to the Reading in payment of claims against the company. Practically the entire stock is understood to be pledged by the Reading as part collateral for its new bond issue. (Nov. 23, 1900, p. 784.)

QUEEN ANNE'S.—The company is reported preparing to issue $330,000 5 per cent. prior lien bonds, $1,400,000 consolidated mortgage bonds and $600,000 4 per cent. income bonds. The prior lien bonds are to be used for making extensions to Love Point and Centerville, Md., and to buy rolling stock. The consolidated will replace an equal amount of first mortgage 5's outstanding and the rest will be used to retire prior lien bonds and provide funds for betterments. (Railroad Construction, Nov. 30, 1900, p. 802.)

READING.—The company, on Feb. 6, declared a semi-annual dividend of 2 per cent. on its first preferred stock, increasing the annual rate from 3 to 4 per cent. Dividends on the first preferred were begun last spring.

RICHLAND & MAHONING.—This company was re-incorporated in Ohio Feb. 6, with a capital stock of $50,000, to take over the property of the old company by the same name and the companies recently incorporated known as the Alliance & Pittsburg and the Akron & Niles. (Feb. 1, p. 87.) The incorporators are the same as those for the Mansfield Short Line above.

ST. CLAIR, MADISON & ST. LOUIS BELT.—The reorganization plan provided by the Whitaker committee, in a circular dated Jan. 2, is as follows:

> Issue a first mortgage to secure $800,000 4 per cent. fifty-year bonds, bearing date Jan. 1, 1901, interest payable July and January, with which to take up the present first mortgage of $600,000, with all arrears of interest at $1,250 in new 4 per cent. bonds for each $1,000 of old bonds, with all past-due coupons attached. This will take $750,000 of the proposed issue, leaving $50,000 in bonds. The parties who own the judgment will take nearly the whole amount due them in bonds at par. There will be left in the treasury $30,000 in bonds for future use as occasion may require. The committee believes that the property can earn as a minimum operating expenses, taxes, and the interest charge on the new issue of bonds. In the year 1900 the gross earnings were $70,894; operating expenses, extraordinary expenses and taxes, $38,573; net earnings, $32,321. (Feb. 8, p. 104.

ST. LOUIS & SAN FRANCISCO.—The company has declared a semi-annual dividend of 1½ per cent. on the second preferred stock, payable March 1, increasing the rate from 2 to 3 per cent.

SOUTHERN PACIFIC.—The stock of this company, acquired by the Union Pacific, is reported to be between $70,000,000 and $80,000,000 of the total issue of $197,832,148. The stock so acquired does not form part of the collateral of the new bonds issued by the Union Pacific to pay for the stock, referred to below. (Feb. 8, p. 104.)

TEXAS & PACIFIC.—The company has declared an annual distribution of 4 per cent. on the second mortgage bonds, payable March 1, against 1½ per cent. a year ago.

TOLEDO & OHIO CENTRAL.—The stockholders, on Feb. 7, approved of the issue of first mortgage and income bonds to buy the Columbus Northwestern from Peoria, Ohio, to St. Marys, 65 miles.

TOLEDO, ST. LOUIS & KANSAS CITY.—Samuel Hunt, receiver of this company, now reorganized as the Toledo, St. Louis & Western, was discharged from the receivership at Indianapolis Feb. 6, by order of Judge Woods. (Jan. 11, p. 34.)

UNION PACIFIC.—Official announcement is made that Kuhn, Loeb & Co. have underwritten an issue of $40,000,000 4 per cent. first mortgage and collateral trust 10-year gold bonds, convertible at the option of the holder before May 1, 1906, into U. P. common stock at par, and redeemable after that date at 102½. The bonds will be offered to stockholders at par, at the rate of one bond for each 50 shares held. They are dated May 1, 1901, interest payable May 1 and Nov. 1, and will form a part of the total authorized issue of $100,000,000, bearing interest at not to exceed 4 per cent., and not less than 3 per cent. per annum. They are secured by all the collateral now in the company's treasury, as well as by first mortgage upon about 1,300 miles of line, forming part of the U. P. system which is not under mortgage. The proceeds will be used to provide funds to pay for the Southern Pacific stock now owned.

VANCOUVER, VICTORIA & EASTERN.—The charter of this road, owned by Mackenzie & Mann, has been sold by them to the Great Northern for $150,000.